

2006 Devils Lake Basin Water Management Plan



PREPARED BY:
Devils Lake Basin Joint Water Resource Board
and the
North Dakota State Water Commission

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Introduction

It was determined by the Devils Lake Basin Joint Water Resource Board (Joint Board) in early 2002, that a need existed to update the 1995 plan, and to re-evaluate its objectives based on more current and enhanced data. That report supersedes the 1995 Devils Lake Basin Water Management Plan (Water Plan) that was a product of the Devils Lake Basin Conceptual Water Management Plan. When the 2002 plan was completed, it was decided by the Joint Board to update the plan at least every three years.

There are three main objectives of the 2006 update of the Water Plan; the first is to utilize local citizenry for their experience and expertise, while still employing the expertise of various state, federal, and private agencies in a non-voting, technical support role; the second is to update and adjust the Water Plan, to more accurately reflect current conditions and needs; and the last is to provide a means of measuring the accomplishments of various entities regarding stated water management goals over time.

The key to water management within the Devils Lake Basin (Basin), is planning at the watershed level, which works at restoring the viability of agriculture, ensuring flood protection for the City of Devils Lake, as well as addressing upper basin flooding, and lastly looking into recreational development for economic diversity.

Mission Statement

It is the goal of the Joint Board to develop a comprehensive, coordinated water management plan for the Basin that will protect the economic and biological values of the Basin while providing optimum benefits for agriculture, wildlife and fisheries, outdoor recreation, economic development, and its' citizens.

To provide some perspective on how much progress has been made in the Basin, a 1987 editorial (selected portions below) from the Devils Lake Journal, has been included to show what the newspaper of the Devils Lake community thought that the future of water management in the Basin should look like.

The Devils Lake Journal
June 29, 1987
By Jack Zaleski, Editor

"Our Opinion: Devils Lake needs a long-range and comprehensive plan"

"...We applaud the action of the Devils Lake Basin Joint Water Management Board and the North Dakota Water Commission declaring the intent of both bodies to co-sponsor an outlet project. The cooperation between a regional water management group and the state commission underscores the importance of opening up the closed Devils Lake Basin. It recognizes both the outlet function as a flood control project and as a mean of improving water quality by promoting flow through the lake."

"...The need for a comprehensive basin water management plan has never been greater. The preposterous proposals made by some people regarding drainage and waterfowl demonstrate how grossly mismanaged the basin's lakes and coulees are now. Before the first shovel of earth for an outlet is moved, a program to monitor and manage the Devils Lake watershed from top to bottom must be in place."

"...The basin is a unique hydrologic unit which encompasses a complex ecosystem. No single interest should dominate its management."

Purpose of the Plan

The purpose of this document is to provide general background on water and land resources, to define water management issues, to update project needs, to state objectives, to provide strategies designed to manage the Basin in a manner that best meets the needs of all interested parties, to set clear goals to be achieved, and to measure the success of those goals and strategies over time. Once the Subject Committees and the Joint Board have approved the updated Basin management plan, the process of implementation of strategies can begin.

Perhaps the most important aspect of this plan is ensuring that all relevant agencies—state, federal, and private organizations—should make a unified effort to achieve the management strategies and objectives of this plan, which will serve as a constant reminder of what actions need to be completed in the Basin.

This plan is a working plan, and in that sense will never be completely finished, and will need periodic updates. It uses a loose-leaf format to outline components of the plan so the results of future work can be added with little effort. Any changes in objectives or strategies must be approved by the Joint Board with consultation from the four Subject Committees, and will be reflected in future plan revisions.

Future Updates

The 2006 update of the Water Plan represents the conditions of the Basin at this time. The purpose of the Water Plan is to provide a convenient and accessible document that will provide the citizens of the Basin and state, federal, and private agencies with a road map of what has been done, what is being done, and what remains to be done.

While this plan intends to give a long-term vision of water management in the Basin, it is the nature of water management issues to change. It is important to continue to make progress towards the Basin's long-term water management goals, while still retaining the flexibility necessary to change this plan to best meet short-term needs.

As a result, the Water Plan will be reviewed every three years, or less if necessary, by the Joint Board, with the assistance of the Subject Committees and Technical Support Groups. The Subject Committees have also recognized the need to keep their objectives, management issues, strategies and procedures current, and have set timetables for the updating of the respective sections.

Maintaining the Water Plan provides long-term guidance, but it is also a document that must be kept current in the overall effort to resolve many of the Basin's water management problems. Many excellent studies have been initiated in the Basin, only to be forgotten or not kept updated. A good example of a study that will need to be continually updated is the Bureau of Reclamation's (Bureau) Road and Railroad Crossing Inventory for all of the main coulees in the Basin. Inventories have been completed on the Mauvais and Big Coulee (1999), Edmore Coulee & tributaries (2000-2001), Calio Coulee (2002), St. Joe Coulee (2003), Starkweather Coulee (2004), and Little Coulee (2005). The responsibility of maintaining this powerful tool for hydrologic modeling has been given to the nine counties of the Devils Lake basin with coordination by the Joint Board, and they have agreed to do so. The success of this plan is dependent upon all interests continually working together for the betterment of everyone.

The Three-Pronged Approach

As a result of the extremely high water levels on Devils Lake and the corresponding land and property damages, the need for a solution to the current water management problems has become apparent. What is needed is a comprehensive, understandable, watershed-level plan to effect true change in the Basin, which this document represents. A three-pronged approach, including upper basin water management, infrastructure protection, and an outlet to the Sheyenne River, has been developed to alleviate flooding in the Basin.

Upper Basin Water Management

The first aspect of the approach is upper basin water management. It is a common misconception that wetland restoration in the upper basin would solve the region's chronic flooding problems all by itself. A fact often overlooked is that because of the efforts of many agencies and groups, significant progress has been made in the restoration and protection of wetlands in the Basin in the past 20 years. Further, landowners have a legal right to drain their land under provisions in North Dakota state law.

In total, it is estimated that approximately 14,000 acres of wetlands have been restored, protected, or enhanced in the Basin for the dual purposes of water storage and wildlife habitat. In the future, an additional 13,000 acres of wetlands have been proposed. If all of the proposed wetland projects are eventually completed, that would

bring the total of restored, and enhanced wetlands to 27,000 acres.

This important work has been accomplished by various agencies, including the Natural Resource Conservation Service (NRCS), the North Dakota Natural Resource Trust (Trust), the North Dakota State Water Commission (Water Commission), and the United States Fish and Wildlife Service (Fish and Wildlife Service). The Joint Board has also played a significant role in continued efforts to increase upper basin storage.

In 2001, the most recent study on upper basin storage, completed by West Consultants, estimated 92,429 acres of possibly drained depressions in the Basin. This means that approximately 14 percent of possibly drained wetland acres have been restored, protected, or enhanced. Further, if the full 27,000 acres of wetlands proposed by various agencies were restored or enhanced, that would mean the restoration of nearly 29 percent of the possibly drained depressions. If approximately 14 percent of the drained wetlands in the Basin have already been restored, and restoration of 29 percent of wetlands is the eventual goal, that represents a significant amount of wetland restoration.

However, efforts to store water in the basin continue, and in 1995 the Water Plan concluded that with the proper incentives to landowners, some wetland areas in the upper basin could hold additional waters in high-flow conditions, and this has been done with the Water Commission sponsored Available Storage Acreage/Extended Storage

Acreage (ASAP/ESAP) Programs, the NRCS, the Trust, and the Fish and Wildlife Service National Wildlife Refuge on Lake Alice. Various governmental agencies have, or are planning the development, management, and enhancement of wetland acres for the dual purposes of wildlife habitat and water storage. The Water Commission enacted ASAP in 1996. This program paid landowners to store water that would have contributed to the flooding around Devils Lake. The program ran from 1996-1999 and stored 8,000-22,000 acre-feet per year at a total cost of \$3.5 million. In 2000, the ASAP evolved into the Extended Storage Acreage Program (ESAP), which involved extended (typically ten-year, rather than one-year) contracts. Under ESAP, the Water Commission signed contracts for eight sites in 2000, which covered 395 acres, and had an approximate storage volume of 800 acre-feet. Those contracts are scheduled to expire on December 31, 2008. In 2003, an additional ESAP contract was signed for 18 acres, with 35 acre-feet of storage. That contract will also run through December 31, 2008.

There have also been five different studies done in the Basin, trying to determine the actual storage of wetland depressions. The most accurate and detailed of these studies is the one completed by the Corps in 2001. However, storing surface water alone is not the whole answer.

In addition to changing the quantity of water flowing into Devils Lake, there have also been projects by various agencies that

address the quality of water, not only in Devils Lake, but also in the Basin as a whole. The United States Geological Survey (USGS) has produced 22 papers on the hydrogeology of Devils Lake since the last plan was published, addressing subjects ranging from variations in water quality in Devils Lake and upper basin lakes, plankton communities, to reconstructing historical hydrological conditions.

Working with a variety of watershed maintenance projects will demonstrate the value of restoration demonstration projects on portions of the Starkweather Coulee and will also showcase the value of different agricultural techniques, such as buffer strips (vegetation planted along watercourses to prevent erosion), or minimal tillage agriculture. These types of projects have the potential to significantly improve the quality of water entering Devils Lake. In addition to actual projects, many of the Technical Support Groups, such as the North Dakota State University Extension Service (NDSU Extension), and the NRCS, have active educational programs in place to increase the sustainability, environmental friendliness, and profit of agricultural land use practices in the upper basin. The various projects and programs in place in the Basin demonstrate the amount of progress that has been made as a result of the 1995 plan. However, much work remains to be done. The Kenner Marsh restoration project has also been a good example of private property owners working with agencies to store water and restore habitat.



Figure 1. Four ESAP sites in the Basin in the spring of 2005.

Infrastructure Protection

The second aspect of the three-pronged approach is infrastructure protection. Since 1996, Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) has paid 500 claims for the purposes of salvage, relocation, and demolition, and an additional 250 claims for the protection of existing structures, totaling over \$28 million.

In May 1999, FEMA contracted for a GPS-based risk assessment inventory of all structures around Devils Lake below 1,465 feet above mean sea level (amsl.) The inventory used digital aerial photography and Light Detection and Ranging (LiDAR), a topographical imaging technology. A total of 890 structures, valued at \$76.9 million, were identified, 139 of which are below 1,450 feet amsl (the level of protection for the City of Devils Lake's

dikes). FEMA has completed this detailed risk assessment around Devils Lake. The contractor for the FEMA LiDAR project has been contracted by the state to help provide a data storage site and web-based data access point to be managed by the North Dakota Information and Technology Division.

Since September 1999, FEMA implemented a closed basin lake flood insurance endorsement replacing the temporary waivers it had been using to handle the continuous lake flooding. As of July 15, 2001, four of nine Devils Lake area NFIP participating communities opted to remain eligible for this closed basin lake flood insurance endorsement by adopting more stringent floodplain management regulations. Benson County, Minnewaukan, Creel Township, and Devils Lake now regulate development below an elevation of 1,460 feet amsl.



Figure 2. Waves crashing over US Highway 281 in 2004. This highway has been rerouted to the west to prevent repeated problems with waves eroding the road.



Figure 3. The aftermath of a storm on US Highway 281 in 2004. Photo courtesy the Benson County Farmers Press.



Figure 4. A road made impassable by rising waters in 2001.

Most of the City of Churchs Ferry was acquired under FEMA's Hazard Mitigation Grant Program at a cost of \$4 million. Two families remain in the city at an elevation above 1,460 feet amsl. The BTR Co-operative Elevator in Churchs Ferry has chosen to relocate the elevator five miles west of the city in Benson County through a combination of programs, including the NFIP, Hazard Mitigation Grant Program, the Economic Development Administration, the Department of Housing and Urban Development, and local funding at a cost of \$11.4 million dollars. Many of these projects were done under the local direction of North Central Planning Regional Council.

Rural acquisitions in Ramsey and Towner counties continue, affecting approximately 24 farmsteads.

The North Dakota Department of Transportation (DOT) and the federal government have spent over \$178 million on improvements and maintenance for roads affected by the rise of Devils Lake. A great deal of work has been completed since 1995, and if waters continue to rise, additional funds will need to be allocated towards road improvements.

Generally, the roads have been raised to an elevation of 1,455 feet amsl; with the base wide enough to eventually go to 1,465 feet amsl and the bridges to 1,465 feet amsl. The DOT began major construction on a final route for U.S. Highway 281, which will be constructed to run west of the City of Minnewaukan, and is estimated to be complete in 2006, with a total cost of \$34.8 million.

The Corps has systematically raised the levees protecting the City of Devils Lake. Construction, beginning in 2004 and completed in the fall of 2005, raised the levee to an elevation of 1,460 feet amsl, which will provide protection from Devils Lake up to 1,454 feet amsl. The total cost for this phase of construction is estimated at \$8.5 million. Additional raises to protect to an elevation of 1,460 feet amsl, the natural outlet elevation, would require significant additions to the dike system, including widening the base of the levee. Work of this sort would likely be extremely costly, and would likely cause further problems in the community, in terms of required condemnations of privately owned property, as the next raise will require doubling the length of the dike to over 14 miles.

While the flooding around Stump Lake has not reached the same magnitude of crisis that it has on Devils Lake, the problem is becoming significant. Five farmsteads, with an estimated replacement value of approximately \$1.2 million, according to Nelson County Water Board member Ben Varnson, will be partially submerged, or made inaccessible between a lake elevation of 1,437 and 1,444 feet amsl. Similar to the City of Devils Lake, the City of Lakota gets its water supply from water lines that are under eastern Stump Lake. Another problem associated with the rising waters of Stump Lake is the flooding of roads. Varnson estimated that the total cost of either raising or moving inundated roads could range



Figure 5. The levee protecting Devils Lake in 2004.

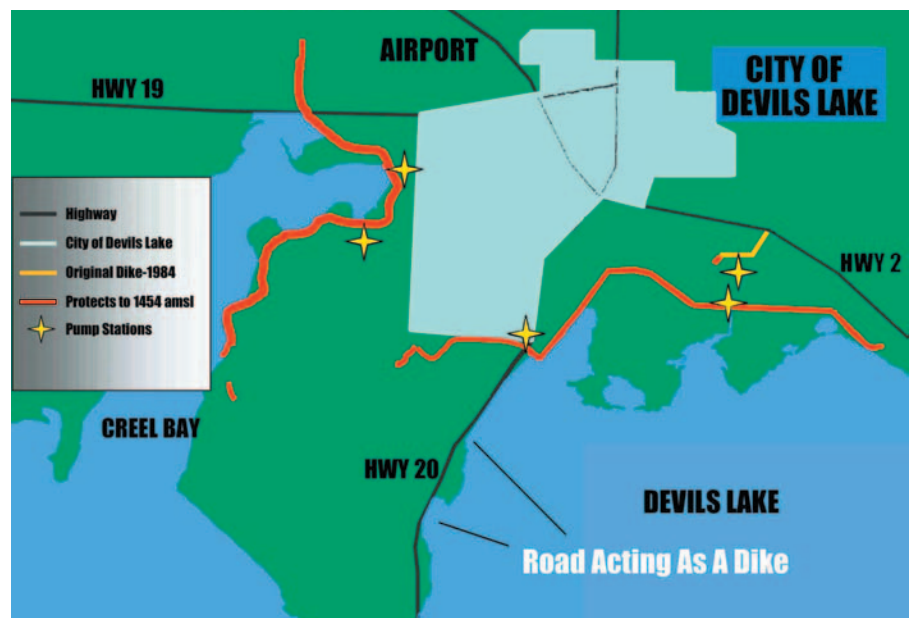


Figure 6. The Devils Lake levee system, and the areas that it protects.



Figure 7. A site in Minnewaukan, before and after a church was removed due to flooding.

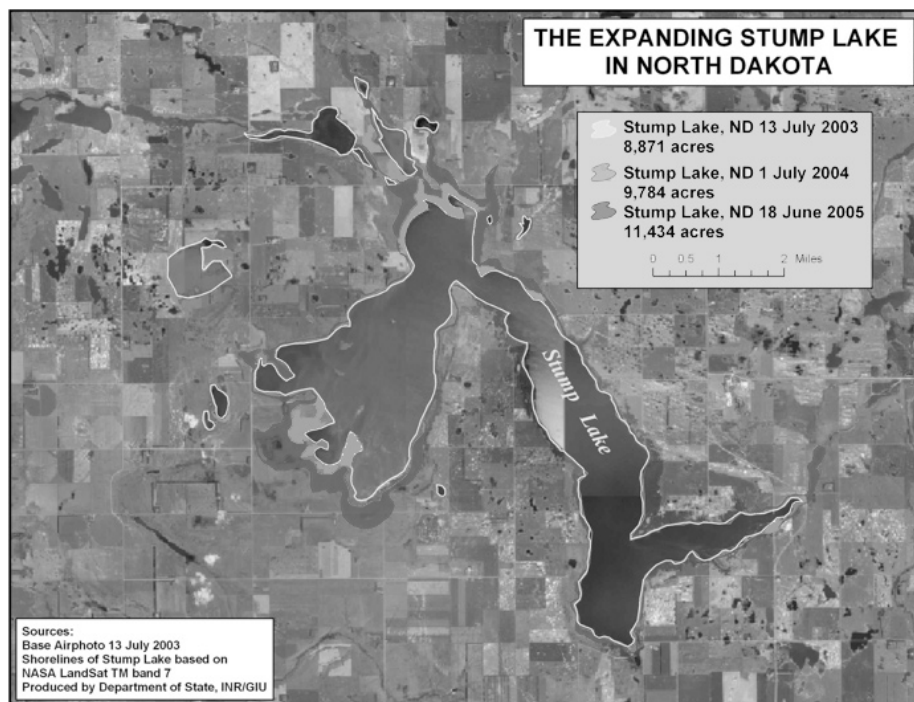


Figure 8. Stump Lake at various elevations.

as high as \$15 million. In anticipation of funds possibly being made available for emergency rerouting, local road and county officials are developing alternate routes that may cost up to \$4.4 million. The Water Commission had \$500,000 earmarked in its budget for Nelson County flooding problems in 2005. Of that amount, \$250,000 was to cover road repairs at 100 percent cost-share, and the remaining \$250,00 will be allocated for various water projects.

The North Dakota State Park System has four parks next to the lake. The Narrows State Recreation Area was flooded in 1995 and is not currently in use, and Grahams Island State Park, Shelters Grove, and Black Tiger Bay Parks have flooded facilities, but remain open. Replacement facilities have been reconstructed at Grahams Island State Park. The relocation project is now complete, and \$1.5 million has been spent to relocate campsites, public facilities, roads, and boat ramps. A recent \$3.5 million road raise to keep Grahams Island State Park has been completed. However, between 1,450 and 1,455 feet amsl, county access road to the park will

be lost, with only the main road remaining open. At 1,455 feet amsl, the entire park area of Shelters Grove, excluding the shop, will be completely flooded. Any lake elevation above 1,448 feet amsl will force the park to close. If the lake reaches 1,449 feet amsl, which it did in both 2004 and 2005, all of the land area of Black Tiger Bay State Recreation Area is flooded.

Several areas adjacent to Highways 20 and 57 are not currently flooded by Devils Lake because the roads are acting as dikes. In March, 2005, the DOT closed Highway 20 along the south shore of Devils Lake (near St. Michael) due to seepage that was occurring through the roadbed. State officials were alerted of the problem when a local resident reported seeing water flowing from the base of the roadbed. In addition, it was possible to see areas where the flowing water had actually eroded a path through the ice on the downstream side of the road. After extensive monitoring, which included test drilling along the base of the roadbed, it was determined that Highway 20 was safe, and it was reopened for travel in April, 2005. The roadway continues to re-

main open for travel, but it is under frequent observation. The DOT, in consultation with other state agencies, has been considering several alternatives to repair the problem. It is anticipated that the most viable option is to build a seepage and stability berm on the downstream side of the road embankment. This will essentially amount to the installation of fill and a collection pipe that will more safely divert the seepage away from the roadbed. In August 2005, Senator Kent Conrad successfully persuaded the Federal Highway Administration to appropriate \$70 million to shore up roads acting as dikes around Devils Lake. This amount will fund 95 percent of the needed repairs.

Over \$1 million has been spent, primarily by FEMA, to relocate pipes and pump stations to keep the Ramsey County rural sewer system operable. Unfortunately, this has not been enough to prevent damage to the water transmission system that supplies the City of Devils Lake. Devils Lake receives its water supply from a well field located on the Spirit Lake Nation, approximately 18 miles to the southeast. Nearly one-third of the transmission pipeline is underwater, and this system is in danger of failure. If a failure occurs, potable water would be unavailable to the city for an indefinite period. Preliminary estimates for new water source development and treatment range from \$10 million to \$30 million. The City of Devils Lake has secured water rights to an aquifer south of Devils Lake, and has received \$500,000 in grants thus far.

Outlet to the Sheyenne River

The State of North Dakota has constructed an outlet project from Devils Lake to the Sheyenne River. An outlet is the third and final prong of the solution.

The first phase of the project is capable of pumping up to 100 cubic feet per second (cfs), with the potential for expansion to 300 cfs. The outlet project consists of two pumping stations, 3.3 miles of pipe, and 9.4 miles of open channel.

Work on the outlet began in October 2002, with the construction of a pumping pad and an access road to the future location of the Round Lake Pump Station. In 2003 and 2004, construction continued, and the State of North Dakota was granted a Section 402 Permit by the North Dakota Department of Health (Health Department) for operation of the state outlet. Operation of the outlet will be constrained by water quality and quantity effects on the Sheyenne River. A lawsuit appealing the 402 Water Quality permit was heard in State District Court, overruled, appealed, and that appeal was finally denied in the summer of 2005.

Operation of the outlet is limited by the permit to only operate under the following conditions: outlet flow additions shall not cause Sheyenne River flow at the outlet discharge point to exceed 600 cfs; seven-day average sulfate concentration measured in samples from the downstream monitoring location shall not exceed 300



Figure 10. The canal leading to the Josephine Pump Station, 2005.

*Figure 11.
The Josephine
standpipe in 2005.*



mg/l; the pH at the downstream monitoring station should remain within the range of 7.0 to 9.0; outlet discharge not to exceed a maximum discharge of 100 cfs (50 cfs during the first year of operation), nor operate outside of the approved seven-month operating period (May through November).

Major construction on the outlet was completed in August 2005, and it was successfully operated for a brief period of time shortly thereafter.

The “Fourth Prong”

While a three-pronged process is being used by the State of North Dakota to deal with flooding problems in the Basin, a frequently overlooked impact is the effect that flooding has had on the economy of the Basin. With over 81,000 acres of farmland inundated, and numerous other impacts to the local and statewide economy, a fourth prong, economic development was developed through the efforts of the Joint Board.

Local officials, businesses, and entrepreneurs in the Basin have worked hard in the last decade toward that end, through efforts such as increasing regional awareness of the many recreational opportunities that the Basin has to offer, drawing people from outside the state.

Some progress has been made in this area, with the Economic Development Subject Committee outlining objectives and strategies in this area. The majority of the work on economic recovery and



Figure 12. The outlet drop structure near the Sheyenne River in 2005.

revitalization has been done at the local level. For example, a report prepared in 2000 by CEO Praxis for the City of Devils Lake and the Mayor's Business Committee, and an economic summit held in Devils Lake in 2000, with over 20 state and federal agencies represented, demonstrates progress in this area. Significant economic development efforts continue to be made by individual community economic development organizations and through partnerships developed since the summit was held.

However, economic revitalization and recovery efforts are often limited by a lack of funding and technical expertise. The small number of programs in this area highlights the need for local citizens, state, federal, and private agencies to focus more of their energy in the future on this vital area. Solving the water management problems of the Basin is not only vitally important to the economic future the communities and residents of the Basin, but has important impacts on the economic viability of the entire State of North Dakota.



Figure 13. Recreation on Devils Lake is a big business.

Background of Devils Lake Basin Water Management

In 1992, The Corps developed a reconnaissance report concerning comprehensive planning in the Basin and the water level of Devils Lake. The Water Commission and the Joint Board at the urging of the local interests, worked with the Corps on the completion of a federal feasibility study looking for ways to manage the Basin's water and Devils Lake water levels.

Reviews of the Conceptual Plan generated the ideas incorporated into a report published 1995. Comments received from reviews of that report were used to develop specific recommendations and implementation strategies that are included in this new comprehensive, basin-wide water management action plan.

The mission assigned to the Devils Lake Basin Task Force appointed by the State Engineer in that earlier process, was to work with the Joint Board and the public to produce a final plan that addressed the Basin's water quantity and water quality issues, while promoting peace and harmony among the various interests in the Basin.

The Devils Lake Basin Task Force developed the 1995 report as an action plan to manage the Basin. There are four main Subject Committees within this report: agriculture, wildlife and fisheries, recreation, and economic development. Each Subject Committee developed its own objectives to pursue the common goal, which was stated in the mission statement.

In 1995, the Water Plan was completed, drawing upon the combined efforts of private citizens, and local interests, utilizing the technical expertise of various state and federal agencies.

Stage I of the feasibility study emphasized quantifying flood risks around Devils Lake. Stage II of the study defined projects and programs needed to stabilize the water level of Devils Lake.

The 1995 Water Plan was important to the feasibility study process, because it addressed the management needs of the entire Basin. A management plan is essential to gain federal approval of any project designed to alleviate the flooding situation currently affecting the Basin.

The 1995 report was a revolutionary attempt to look at the entire basin in respect to its issues and resources and to clearly define the contemporary water management needs that existed in the Basin. It was an interim step to clearly define the actions that must take place in order to resolve water issues in the Basin. The Basin Task Force determined that all concepts and proposals contained in the report would require continued discussion and refinement. Cooperative efforts would be made through the Joint Board to resolve identified problems.

In early 2002, the Joint Board decided to revisit the Management Plan, keeping what worked, and modifying or eliminating what did not. In the 1995 plan, local representatives from various private, state and federal agencies adopted a series of broad goals via consensus. As a result, the 1995 plan was successful in that it brought diverse interests together on very general goals, but more specifics were needed in order to go further. Local water boards also played a limited role in the decision-making process. Because of this fact, the 2002 Management Plan approached the issues of water re-

source planning in a slightly different manner, by being even more locally driven and directed.

With this new approach, the planning process was directed largely by local water board members appointed to the Joint Board, and by the four main Subject Committees which drew representation from each of the Basin's nine counties. In the 2002 Management Plan, state, federal and local agencies still played a vital role, but instead of directing the process, agencies provided the Joint Board and subject committees with the technical support and expertise that they lacked.

In early 2005, the Joint Board began updating the plan again. Given the success achieved through the 2002 plan, the process remained largely unchanged. However, two significant changes were accomplished in the Subject Committee section. It was decided to identify several specific goals that the committee wanted to see accomplished prior to the next update of the water plan, giving the Joint Board a means of measuring their progress. In addition, the Subject Committees wanted to show what things had been accomplished in the Basin, in the context of their specific goals.

This concept of local direction is a large part of the reason that the Water Plan has enjoyed success. Local citizens are provided a forum, whereby they can articulate their interests and concerns, while drawing on the expertise that the various agencies are able to offer. The process that evolved from initial efforts in the early 1990s has played no small part in the success of working towards dealing with the water management issues of the Basin.

Devils Lake Basin Joint Water Resource Board



Figure 14. The Joint Board held a meeting in 2003 to address the concerns about coulee maintenance in the Basin.

In 1979, six county water resource districts (Benson, Cavalier, Nelson, Pierce, Ramsey and Towner) joined together under the joint powers agreement granted by the North Dakota Century Code 61-16.1-11. This organization was formed to replace the Devils Lake Basin Advisory Committee. In 1980 Rolette and Walsh Counties joined with the six original counties. And finally, in 1997, the Joint Board reorganized with a new joint powers agreement and added Eddy County as a member, bringing the total number of member counties to nine.

The Joint Board is comprised of one water resource district representative selected by each member county. In January of each year the Board reorganizes electing a Chairman and Vice Chairman from the county representatives.

The Joint Board's mandate is:

"...that a Joint Board is necessary for a coordinated and cooperative approach to water management in the Devils Lake Basin...it was recognized by the water resource districts of the Devils Lake Basin that one entity representing the entire Devils Lake Basin would better represent the area concerning planning and implementation of a complete water management plan for the Basin, and that one entity could better represent the entire Devils Lake Basin in dealings with the federal, state and other local governments."

2006 Devils Lake Basin Joint Water Resource Board of Directors

Carl Duchscher, Benson County
Larry Gellner, Cavalier County
Mike Tweed, Eddy County
Mike Donohue, Nelson County
Duane Hawk, Pierce County
Les Windjue, Ramsey County
Ronald Heinz, Rolette County
Dale Anderson, Towner County
Bob Shirek, Walsh County



Figure 15. The 2006 Devils Lake Basin Joint Water Resources Board. Back row (L to R): Larry Gellner, Carl Duchscher, Duane Hawk, Mike Tweed, Les Windjue. Front row: Dale Anderson, Ronald Heinz, Bob Shirek, Mike Donohue.

Subject Committee Representatives

The 36 Subject Committee representatives were appointed by their respective counties and the Joint Board for the 2005 update of the Water Plan. The fundamental concept behind the Water Plan is to have a plan that is representative of the interests of the citizens of the Basin. As a result, the majority of the Subject Committee Representatives were private citizens who had an active interest and expertise in one of the four subject areas: agriculture, recreation, wildlife and fisheries, or economic development. These hard-working citizens devoted many hours of their time for the betterment of the Basin.

Subject Committee Representatives

BENSON COUNTY
Agriculture-Jason Lee
Wildlife & Fisheries-Barry Cox
Recreation-David Johnson
Economic Development-Bruce Terpening

CAVALIER COUNTY
Agriculture-Richard Flanders
Wildlife & Fisheries-Harold Nowatzki
Recreation-Ray Rollness
Economic Development-Carol Goodman

EDDY COUNTY
Agriculture-William Starke
Wildlife & Fisheries-Travis Peterson
Recreation-Clayton Quam
Economic Development-Morgan Lies

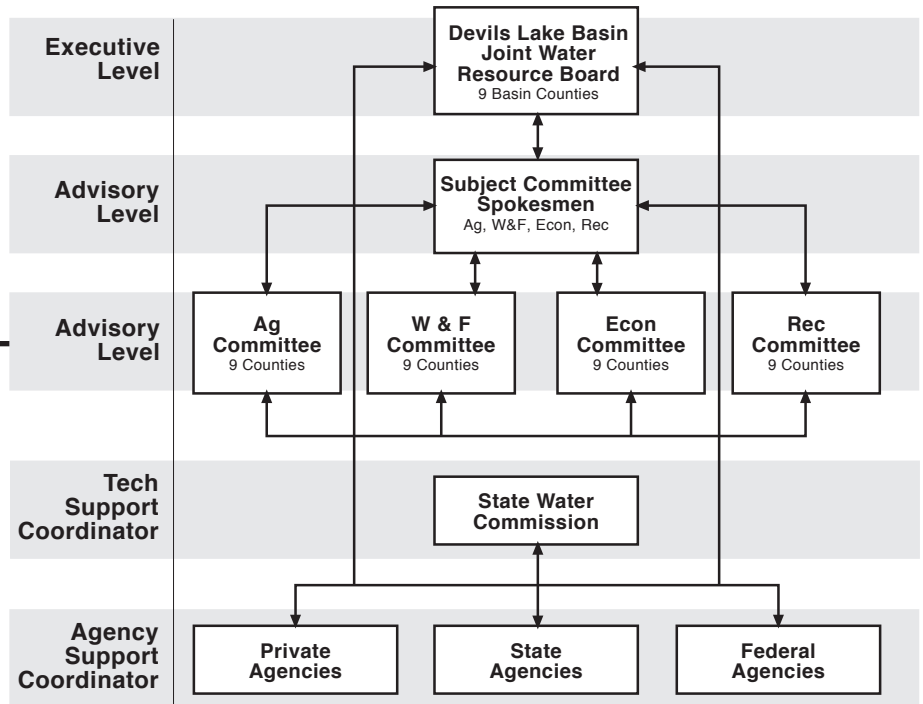


FIGURE 16: Organizational flow-chart for the 2006 update of the Devils Lake Basin Water Management Plan. Note that the Devils Lake Basin Joint Water Resource Board coordinates all activities in this process.

NELSON COUNTY
Agriculture-David Thompson
Wildlife & Fisheries-Dale Varnson
Recreation-Larry Johnson
Economic Development-Denise Hendrickson

PIERCE COUNTY
Agriculture-Robert Fritel
Wildlife & Fisheries-Kermit Peters
Recreation-Dondi Sobolik
Economic Development-Gerry Jacobson

RAMSEY COUNTY
Agriculture-Dan Webster
Wildlife & Fisheries-Kyle Blanchfield
Recreation-Barb Britsch
Economic Development-Richard M. Anderson

ROLETTE COUNTY
Agriculture-Dan Boe
Wildlife & Fisheries-Lee Lewis
Recreation-Scott Mitchell
Economic Development-George Youngerman

TOWNER COUNTY
Agriculture-Dale Anderson
Wildlife & Fisheries-Curtis Jun-tunen
Recreation-John Elsperger
Economic Development-Joanne Rodenbiker

WALSH COUNTY
Agriculture-Jack Karas
Wildlife & Fisheries-Dale Zahradka
Recreation-Cory Kouba
Economic Development-Mike Hodny

Technical Support Agencies

The Technical Support Agencies were invited to participate in the planning process, because the Joint Board felt that these particular groups had the technical expertise necessary. Each of the agencies appointed representatives to work with the Subject Committees.

The Technical Support Agency Representatives acted in only an advisory role, and as such, had no voting rights, being present primarily as a resource and a sounding board for ideas developed by the Subject Committees.

Technical Support Agency Representatives

Garrison Diversion Conservancy District: David Koland, General Manager

Lake Region Anglers Association: Ed Dosch

Natural Resource Conservation Service: Andy Wingenbach

North Dakota Department of Health: Mike Sauer, Environmental Health Section, Water Quality Special Projects

North Dakota Forest Service: Tom Berg, Staff Forester

North Dakota Game and Fish Department: Terry Steinwand, Director

North Dakota Natural Resources Trust: Sharon Clancy

North Dakota Parks and Recreation Department: Dick Horner, Manager, Devils Lake Parks

Lake Region Sportsman's Club: Bill Byram

North Dakota State University Extension Service: Terry Gregoire, Area Extension Specialist/Cropping Systems

North Dakota State Water Commission: Tim Freije, PE, Devils Lake Basin Water Resources Engineer

North Dakota State Water Commission: Lee Klapprodt, Director, Planning and Education

North Dakota State Water Commission: Michael Noone, Planner III

United States Army, Corps of Engineers: Tom Sulley

United States Fish and Wildlife Service: Roger Hollevoet, District Director

United States Geological Survey: Gregg Wiche, District Chief

Subject Committee Recommendations

Through a series of meetings in 2005, the Subject Committees reviewed recommendations developed in the previous plan, and reevaluated them based upon current conditions.

Agriculture

GOALS:

1. Ensure that the rights of property owners are protected.
2. Increase both the economic and environmental benefits of agriculture through the implementation of better land and water management practices.
3. Provide flood protection for private and public lands sufficient to protect against a specific flood event.
4. Develop specific plans and goals, for the Joint Board and the sub-basin advisory boards, in order to promote better conservation management practices.
5. Identify local, state and federal regulations that can help or hinder implementation of the Water Plan.
6. Increase farm income through increased commodities production using better water management practices, such as the development of the Upper Basin Water Utilization Test Project.

Goal 1: Ensure that the rights of property owners are protected.

OBJECTIVES:

1. Analyze all Water Plan activities, in order to determine if private property owners' rights are being protected.
2. Consideration of the needs of agriculture to be taken into account for township and/or county zoning regulations.
3. The Joint Board should continue the development and utilization of a Devils Lake Basin Watershed Maintenance Program, which will emphasize management of water quality issues, such as conservation practices on coulee cleanouts, and Confined Animal Feeding Operations (CAFOs.)

Goal 2: Increase both the economic and environmental benefits of agriculture through the implementation of better land and water management practices.

OBJECTIVES:

1. Develop mechanisms to address the problem of Basin soils that are considered to be saline, and continue the research of techniques used to identify the various water management practices effects on salt movement and accumulation. Utilize information gathered through the Upper Basin Water Utilization Test Project in order gain a better understanding of the relationship between water quality and soil salinity.
2. Support NRCS funding of the Emergency Watershed Protec-

tion (EWP) program to help explore compensation alternatives for inundated agricultural acres around Devils Lake. Utilize the program's "farm when you can" acreage. Also consider providing funding through the "Preventive Planting" program, or any other possible alternatives.

3. Urge the Joint Board and other relevant agencies to work closely with the farming community to distribute information gathered through the Upper Basin Water Utilization Test Project during the three years of its operation (2005-2007) and incorporate that information into the 2008 update of the Water Plan.

4. Continue to work with local, state and federal officials on the economic impact of flooding in the Basin in the agricultural sector, using information contained in "A Blueprint for Economic Recovery and Revitalization" and other studies. Update this plan to reflect changes in the situation.

5. Ensure that the Devils Lake Outlet Operating Committee takes into account private lands and production losses when setting lake operation levels.

6. Encourage appropriate entities to work together on developing land compensation solutions for inundated acres in the basin.

7. Encourage the Joint Board to continue its work to secure local, state, federal, and non-profit funding for various water management projects, including: the Devils Lake Basin Watershed Maintenance Program; and a method for providing payments for inundated agricultural land.



Figure 17. Dr. Dean Steele of NDSU, talks to farmers about the Devils Lake Water Utilization Test Project in 2005.



Figure 18. Irrigation in the Basin in 2005.

Goal 3: Provide flood protection for private and public lands to protect against a specific flood event.

OBJECTIVES:

1. Continue to promote upper basin water storage through programs such as ESAP, and or-

ganizations such as the Fish and Wildlife Service, Game and Fish, NRCS, and others.

2. Continue to develop management practices for water storage and handling in the basin to minimize crop losses (i.e., Grand Harbor Watershed Management Project.) This could be accom-

plished by encouraging sub-basin advisory boards to assist in the development and enforcement of plans to manage various size rain events in order to minimize local losses and to help manage water flows for the benefit of downstream entities, and demonstration projects tailored to individual watersheds in the Basin, thereby creating interest in individual farmers for better management practices. Further, the committee urges the grassing all major coulees in the Basin by 2008.

3. Develop procedures that address those issues that arise from the use of private and public lands to alleviate flooding.

4. Pursue a coordinated watershed maintenance program, through the development of improved communication using the Joint Board, and standard practices that utilizes existing methodologies with adequate funding for sub-basins using NDCC 61-16.1-09.1 authorization. The committee urges the Joint Board to gain sufficient funding, in order to establish a demonstration site that would showcase the effectiveness of this approach.

5. Strongly encourage that the Joint Board and its member counties maintain the road crossings inventory provided to the counties and Joint Board at no cost. The committee recognizes the value in this information in accomplishing important tasks such as coulee maintenance, and understands that keeping this information up-to-date is of vital importance to the Basin.

Goal 4: Develop specific plans and goals for the Joint Board and the sub-basin advisory boards, in order to promote better conservation management practices.

OBJECTIVES:

1. Encourage the continued monitoring of tillage practices and reduced tillage operations. Encourage the development of a program that assesses coulee maintenance costs based upon land use practices (i.e., minimal tillage practices would be worth a lesser amount than when no soil conservation measures are in place).

2. Encourage the Joint Board and sub-basin advisory boards to work with NRCS "Local Work Groups" (NRCS, Soil Conservation Districts, County FSA, and County Extension Agents) with the goal of securing funding for specific projects and programs.

3. Use both NRCS and other agency programs developed through future farm bills to help fund those conservation practices enacted by individual farmers.

Goal 5: Identify local, state and federal regulations that can help or hinder implementation of the Water Plan.

OBJECTIVES:

1. Provide adequate input from both the agricultural community and affected property owners, in order to establish a lake level that provides for continued production or compensates property owners.

2. Develop mechanisms whereby payment-in-lieu-of-taxes that are made on land in the Basin, are equal to the full amount of property taxes that were paid prior to a public or non-profit gaining ownership of that land.

3. Discourage the purchase of private lands by any sovereign nation, in order to ensure the amount paid to local taxing authorities remains the same.

4. Provide better education on the value of wetlands to basin residents including current regulations and/or voluntary wetland agreements.

5. Ensure that local entities have input into any future wetland regulations that would impact the basin, and recommend that the Joint Board investigate new NRCS wetland designation policy and take appropriate action if necessary.

6. Balance the needs of agricultural producers with the goals of regulatory agencies for the protection of wildlife and fisheries.

7. Investigate the development of a basin-wide "wetlands bank" for use in mitigating acres of wetlands being altered by either private or public entities.

Goal 6: Increase farm income through increased commodities production using better water management practices, such as the development of the Upper Basin Water Utilization Test Project.

SPECIFIC ACTIONS TO BE ACCOMPLISHED OR INITIATED PRIOR TO THE 2008 WATER PLAN

1. The Joint Board should take the lead role in working with all appropriate entities to achieve the goal (mentioned under Agriculture in the 2002 plan) of planting all of the major coulees in the Basin with buffer strips.

2. Secure funding to compensate landowners for inundated acres in the Basin.

3. Develop feedlot zoning regulations on a basin-wide level. These regulations can be based upon similar regulations that have been developed by Benson, and Ramsey Counties.

4. Develop an additional 1,000 acre-feet of floodwater storage in the Basin.

ACCOMPLISHMENTS SINCE THE 2002 WATER PLAN

1. Requested and received an opinion from the State Attorney General on the issue of ownership of inundated land after waters have receded. This is an issue that has been of some concern to Basin landowners, and was referenced under Agriculture in the 2002 plan.

Economic Development

GOALS:

1. Capitalize on the economic resources of the Basin regardless of water levels.
2. Create a basin-wide economic development effort utilizing existing Basin economic development organizations.

Goal 1: Capitalize on the economic resources of the Basin regardless of water levels.

OBJECTIVES:

1. Adjust marketing efforts, from a business development standpoint, based upon the opportunities available at various lake levels.
2. Encourage Basin residents to explore economic activities through improved water management (including fee hunting, public access hunting and continuing to promote educational programs on available economic opportunities.)
3. The Joint Board should work with the small business development center (SBDC) and other local, state, and federal agencies in order to secure funding and staff from the North Dakota university system to study the economic benefits available through proper use of public lands (i.e., a study in Towner County on the impacts of Delta Waterfowl on the local economy).
4. Increase the agriculture sector's net return through improved water management in the basin.
5. Closely monitor the progress on the Upper Basin Water

Utilization Test Project over the next three years in order to evaluate the economic impact of the project on the Basin and the State of North Dakota.

6. Encourage the development of non-traditional income producers (bed & breakfasts, bird watching, rural vacation packages, and a trail system,) such as the Lost Prairie Lodge in Alsen.

7. Utilize the expertise and information available from NDSU Research and Extension Centers that serve the Basin, to develop value-added opportunities in agriculture.

8. Ensure that the basin-wide community's infrastructure capabilities are adequate to support increased economic development activities and ensure a quality of place for current and future residents of the Basin (including, but not limited to: specialty crops; adequate roads, including future maintenance needs; adequate airport, airline and charter services; motel and resort facilities; medical and educational facilities and services; potential uses of crops in the pharmaceutical industry; community and rural utilities).

9. Support the Water Plan's Recreation Committee recom-

mendations on increasing tourism related activities throughout the Basin.

10. The Joint Board should investigate the possibility of using the Internship Program being sponsored by the Devils Lake Regional Partnership in order to secure and intern for the conducting specific research on the economic impact of various things on the Devils Lake community.

Goal 2: Create a basin-wide economic development effort utilizing existing Basin economic development organizations.

OBJECTIVES:

1. Promote increased communication and cooperation between Basin economic development groups through an increase in efforts of coordination; such as four of the Basin counties who have cooperatively developed paid staff positions for economic development.

2. Develop a closer working relationship with other economic development groups throughout the Basin, including the two regional planning councils, CONAC (Center of North American Coalition <REAP Zone>), the Small Business Development Center, the Dakota Certified Development Corp, the Work Force Training and Development Program for Northeastern North Dakota, Biz-Pathways, the Lake Region State College, the North Dakota Department of Commerce, Resource, Conservation, and Development, and any other agency or group as appropriate.

3. Hold annual meetings of the representatives of all Basin economic development organizations to set priorities in the implementation of plans and projects. This process should be initiated and coordinated by the Joint Board. This effort can be accomplished by holding annual meetings between the various communities in the Basin, starting in the 4th Quarter of 2005. The goal of these meetings will be to exchange ideas between different communities and develop a closer working relationship among Basin economic interests, to continue to encourage cooperative ventures and projects; including, but not limited to: labor market studies, regional and national trade shows and ND Department of Commerce programs, and to investigate the possibility of other counties in the Basin to become financial partners in this partnership.

SPECIFIC ACTIONS TO BE ACCOMPLISHED OR INITIATED PRIOR TO THE 2008 WATER PLAN

1. Complete campground facilities for the Lake Upsilon recreational area in Rolette County.
2. Hold annual economic development meetings between economic entities of the Basin annually in December.
3. Create a minimum of ten new internships in the Basin annually prior to the 2008 update of the DLBWMP with the dual purposes of creating jobs in the Basin, and making people more interested in living there.

4. Support the development of the Heart of North America Trail system prior to 2008.

ACCOMPLISHMENTS SINCE THE 2002 WATER PLAN

1. A small business center developed in the Basin. Between 2003 and 2005, 2,295 hours were spent assisting 469 businesses within the Basin.
2. In the summer of 2005 nine interns were placed in the region by the Northeast North Dakota Internship Program. In 2006, commitments have been received for five intern positions for Cavalier County, five from Forward Devils Lake, and three from Towner County.

3. Increasing levels of cooperation and coordination among Basin economic development entities in the realm of pooling of resources, and talent, and focusing on the unique values of each area. Examples of these partnerships include: a partnership between Towner County, Cavalier County, Ramsey County, and the City of Rolla; and work between three regional planning councils, North Central, Red River, and Souris River.

4. Worked to gain funding for flood protection of the Grahams Island State Park road, and Wood Rutten bridge.

5. Construction was initiated on a recreational area on Lake Upsilon in Rolette County, through completion of the development of a beach and picnic area.

Recreation

GOALS:

1. Stabilize Devils Lake to enhance recreational opportunities in the Basin.
2. Develop recreational opportunities in the Basin.

Goal 1: Stabilize Devils Lake to enhance recreation opportunities in the Devils Lake Basin.

OBJECTIVE:

1. Continue to operate the state outlet for the stabilization of Devils Lake, and continue to investigate other avenues for water stabilization, such as the Upper Basin Water Utilization Test Project.

2. Establish a variance level for Devils Lake to enhance recreational development.

3. Encourage basin-wide establishment of 'water rights' for Basin waters, and water permitting that will have an effect on the waters of Devils Lake and also with emphasis on the waters of the Sheyenne River (upstream).



Figure 19. Children fishing on Devils Lake.

4. Strongly encourage the Joint Board to be informed and actively involved in County Water Board projects that have the potential to impact recreational opportunities on Devils Lake.

Goal 2. Develop recreational opportunities in the Basin.

OBJECTIVES:

1. Address the lack of sufficient overnight camping facilities, area parks with adequate swimming facilities, camping and picnicking facilities with adequate road access for all types of vehicles around Devils Lake.

2. Investigate the legality and feasibility of the creation of a "Devils Lake Basin Recreation Authority," using the Basin's watershed boundaries, and working through each of the nine county commissions. Ideally, this commission would use tax dollars levied to help leverage other state and federal funds for park projects needed in the Basin, such as is being done by the Lake Upsilon Recreation Committee.

3. Maintain and expand all-season lake access and parking, public boat launching facilities with adequate parking, improved shoreline fishing access, fish

cleaning stations, rest rooms and docking.

4. Support private or other expansions of marina facilities with slip space availability and investigate other boat storage facilities.

5. Continue to encourage and support the stocking of Basin lakes as needed by type and species, in order to help maintain the nationwide reputation of the Devils Lake fishery.

6. Promote "customer satisfaction and service" through programs developed by Lake Region State College, Chambers of Commerce and other similar organizations.

7. Support the economic development of Devils Lake through encouraging a private feasibility study of a convention or conference center located on the lake, with or without a hotel attached, including potential uses. The study would include funding sources for construction and operation and management.

8. Assist in the reshaping of public perception so that all sportsmen feel welcome.

9. Continue efforts to educate general public about courtesies relating to hunting and fishing in the Basin.

10. Promote landowner's perception of waterfowl as an "asset" rather than a "liability," through support of the Economic Committee's proposal to develop a study on this subject.

11. Increase non-consumptive wildlife recreational in the Basin, such as the Sullys Hill birding festival, and efforts by Delta Waterfowl in Towner County through the use of promotion, education, increased viewing sites, other marketing efforts and infrastructure investment.

12. Promote expansion of agricultural 'tourism' with local farmers including crop tours, farm and ranch vacation packages including suitable marketing materials.

13. Secure support for expanded recreational opportunities in the Basin by providing economic benefit information to State Legislators, farm organizations, financial institutions and other involved parties.

14. Work to develop basin-wide recreational information brochure that will provide an inventory of recreational opportunities in the Basin including: golfing, community celebrations, bike trails, snowmobile trails, cross country skiing areas, museums, historical sites, bird watching opportunities and other recreational activities.

15. Coordinate the Devils Lake Basin Recreation plan with the State Recreation plan and other agency plans as it is revised and updated.

16. Coordinate information transfer and studies done by state agencies to determine economic benefits to Basin recreational programs.

17. Encourage state agencies to cooperate with Basin recreational organizations in the promotion of international tourism, such as local chambers of commerce working with potential travel agencies.

18. Hold annual meetings of the representatives of all Basin recreational promotional organizations to set priorities and discuss plans and projects. These meetings should be initiated and coordinated by the Joint Board. Such meetings should be held at various recreational sites throughout the Basin, such as Grahams Island State Park, Stump Lake Park, or the proposed Lake Upsilon Recreation Area.

19. The Recreation Committee fully supports the efforts of the Joint Board, and Wildlife and Fisheries Committee on dealing with Aquatic Nuisance Species (ANS) issues in the Basin because the Recreation Committee recognizes the possible significant impacts to recreation throughout the basin.

SPECIFIC ACTIONS TO BE ACCOMPLISHED OR INITIATED PRIOR TO THE 2008 WATER PLAN

1. Maintain knowledge of, and active involvement where possible in future water permitting issues that have the potential to impact the waters of the Basin. This should be pursued with the long-term goal of water management at the Basin level.

2. Encourage the assembly of information related to the development of a Devils Lake recreational district.

3. Encourage the development of joint recreational groups, patterned on the groups that resulted from the recommendations of the 2002 Economic Development Committee.

4. Encourage the holding of annual meetings, beginning in 2005, where recreational opportunities can be discussed.

5. Encourage the development of a master list of recreational opportunities throughout the Basin, possibly through the use of the summer internship program.

ACCOMPLISHMENTS SINCE THE 2002 WATER PLAN

1. Worked to gain funding for flood protection of the Grahams Island State Park road, and Wood Rutten bridge.

2. Economic Development and Finance, a division of the State Department of Commerce, has begun to take a stronger role in promoting tourism throughout North Dakota.

3. The Devils Lake Flooding Brochure, which provide information on recreation in and around Devils Lake, was updated in 2005.

4. An additional campground was constructed and a comfort station was relocated at Grahams Island State Park, and new facilities built at Black Tiger Bay for a total cost of approximately \$350,000.

5. Construction on the Heart of Dakota Trail system has begun.

6. The Devils Lake Basin Water Stewardship Award was created to recognize significant efforts in water resource management.

Wildlife and Fisheries

GOALS:

1. Enhance grassland, woodland and wetland acreages for the betterment of wildlife and fisheries production in the Basin.

2. Manage water quality for the benefit of Basin fisheries and wildlife.

3. Encourage continuation and intensification of agricultural conservation practices that are beneficial to agriculture, wildlife and fisheries in the Basin.

4. Implement programs that encourage increased youth participation in hunting, fishing and outdoor recreation.

5. Improve communication between agricultural and outdoor interest groups.

6. Joint Board should endorse, support and promote ANS control efforts as it relates to Basin waters.

Goal 1: Enhance grassland, woodland and wetland acreages for the betterment of wildlife and fisheries production in the Basin.

OBJECTIVES:

1. Estimate, on a regular basis, the acreage of quality habitat available, utilizing NRCS where possible, along with USGS and NDSU LandSat information to track land use trends.

2. Continue to explore and develop methods that will enhance the quality of existing habitat (i.e., PLOTS program and Water-Bank). Examine the potential for converting CRP into pastureland when the contract expires, while providing sufficient water supply for animal production without additional fencing. This will be accomplished by working with Basin county agents, the NRCS, soil conservation districts, and other agencies to get information out to the public.

3. Ensure that private and public land ownership rights are respected.

4. Determine the impact of water levels in the Basin on wildlife and fisheries habitat, coordinating with data gathered by Game and Fish. This data should be made readily available to the public.

5. Ensure public input on issues regarding wetland retention.

6. Fund existing voluntary programs and create new incentives to improve the quality and diversity of habitat on private



Figure 20. An old schoolhouse in Webster in 2003 that has been converted to a hunting lodge.

lands and encourage the use of conservation practices, such as will be developed through the Basin Watershed Maintenance Program.

7. Maintain existing programs designed to monitor and test established enhancement methods, while working to secure funding and sources of useful information on various programs already in place in the Basin (i.e. predator exclusion programs in Towner County, and fish stocking in Basin lakes).

8. Continue to encourage the management of federal, state, non-profit, and private lands to improve production of wildlife and fisheries.

9. Encourage the stocking of fish in viable lakes within the Basin through Game and Fish, and the measurement and evaluation of current stocking programs to guide future stocking efforts.

10. Encourage appropriate entities to work with county water resource district boards and the Joint Board in the replanting of trees in formerly flooded and other areas in the Basin.

Goal 2: Manage water quality for the benefit of Basin fisheries and wildlife.

OBJECTIVES:

1. Maintain a basin-wide water quality monitoring program. Utilize information gathered through the water quality and trend analysis study that is currently underway and being funded cooperatively by the USGS, Water Commission, Red River Joint Board, and the Joint Board to help determine what programs need to be updated or changed.

2. Identify land management practices that affect and improve water quality, such as sewage systems in small rural communities, agricultural practices, the Health Department community action programs, and CAFOs. Continue to expand on the implementation of high residue tillage, nutrient management, erosion control, livestock waste management and other sound agricultural management practices.

3. Continue to develop and implement programs that inform the community of the impor-

tance of water quality initiatives. Continue developing strategies to implement water quality practices, through programs such as: Project WET (Water Education for Teachers) workshops; Annual Joint Board Tour for water boards and county commissioners; work with North Dakota Water Education Foundation on summer Basin tours; and the North Dakota Rural Water System's wellhead protection program.

Goal 3: Encourage continuation and intensification of agricultural conservation practices that are beneficial to agriculture, wildlife and fisheries in the Basin.

OBJECTIVE:

1. Identify and coordinate efforts with potential funding sources such as county soil conservation districts, the Red River Riparian Project, the Regional Planning Council, and the NRCS, that will provide greater incentives for conservation practices.

Goal 4: Implement programs that encourage increased youth participation in hunting, fishing and outdoor recreation.

OBJECTIVES:

1. Identify methods designed to increase interest in hunting, fishing and outdoor recreation, through work with organizations such as the Lake Region Anglers, local county agents, and Game and Fish, who focus on promoting existing and helping to create new programs in the Basin.

2. Maintain youth educational and safety programs.

3. Encourage creation and expansion of programs that are intended to facilitate youth hunting and fishing.

Goal 5: Improve communication between agricultural and outdoor interest groups.

OBJECTIVES:

1. Establish basin-wide, land-owner and outdoor interest organizations, and investigate the possibility of working with Game and Fish to become involved in their regional meetings in the Basin.

2. Identify reasons for conflict, and promote the need for compromise where possible between local residents and others.

3. Address methods designed to resolve conflicts through increased communication, by using programs such as Project WET, in order to aid in the dissemination of information on the Basin to educators and others.

4. Promote the education of community residents and visitors about the respect and courtesies required for good landowner and outdoor interest organization relations.

Goal 6: The Joint Board should endorse, support, and promote ANS control efforts as it relates to Basin waters.

OBJECTIVES:

1. Work with state, federal, private agencies, tourism groups, chambers of commerce, and other interested entities to increase

awareness of, and develop educational materials on the risks of biota transfer.

2. The Joint Board should continue its work with local groups, state and federal agencies, in order close off likely areas of hydrologic connections between the Devils Lake and other basins, in order to avoid the introduction of unwanted aquatic species in the valuable fisheries of the Basin.

3. Help to educate local organizations and governmental agencies on the value of the Devils Lake fishery to the local and state economy.

4. Work with local organizations and agencies in order to promote Devils Lake as a "national" fishery, while providing education and practical measures to prevent the introduction of ANS.

5. Continue to investigate and inventory potential interbasin transfer points in all of the nine Basin counties.

SPECIFIC ACTIONS TO BE ACCOMPLISHED OR INITIATED PRIOR TO THE 2008 WATER PLAN

1. Support the efforts of various agencies and groups, as coordinated by the Joint Board, to prevent the possible introduction of ANS into the Basin via the Billings Lake area connection or any other interbasin water transfer points.

2. The Joint Board should work with the NDGF and other agencies to secure the appointing of a representative from the Joint Board on the State ANS Committee.



Figure 21. Tim Freije, Water Commission, addresses the public at a meeting held in Munich in 2004 to discuss the Billings Lake issue.

ACCOMPLISHMENTS SINCE THE 2002 WATER PLAN

1. Additional perch were stocked in Devils Lake in 2005 at the request of local angling interests.

2. Regular estimates of habitat quality and acreage are being conducted.

3. All of the funds available through the Waterbank Program in the Basin have been utilized.

4. The Joint Board, in cooperation with the USGS, the Red River Joint Board, and the Water Commission, have funded the collection, and analysis of water quality in the Basin over the past decade.

5. Water quality data has been collected on the Edmore and Mauvais coulees, and other areas, to determine a baseline on conditions in areas that might potentially be affected by CAFOs.

6. A State ANS Task Force was developed in 2005.

7. A survey of potential interbasin water transfer points in the basin was completed in 2005.

8. A cost-shared survey of the Billings Lake interbasin transfer location was completed in 2005, with an engineering analysis expected to be complete in early 2006.

Results and Developments Since the 2002 Plan

There has been a great deal of work done by many different state, federal, and private agencies since the 2002 plan was completed. Projects have focused on water storage, water quality, habitat restoration, wildlife enhancement and restoration, infrastructure protection, and the extensive background work required for construction of the outlet and the heavily altered Missouri River diversion project (Red River Valley Water Supply Project). As a result, the Basin is perhaps the most exhaustively studied region in North Dakota.

The following section details some of the major projects and dollars spent studying the Basin, and potential repercussions of the Devils Lake outlet. Beyond what is listed here, each of these organizations along with many others, have devoted innumerable man-hours of study and research in the Basin.

Bureau of Reclamation

The Bureau, part of the United States Department of the Interior, has a mission statement of "...to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public." In line with these goals, the Bureau has recently completed a "Road and Railroad Crossing Inventory" for the Edmore, Mauvais, Big Coulee, St. Joe, Little, and Calio Coulees. This project is important, as it will greatly enhance the ability of agencies and individuals to design

more accurate hydrological models of the Basin. The Bureau has also done a wetlands inventory and drained wetlands water storage capacity estimation for the St. Joe-Calio Coulee sub-basin of the Basin.

Devils Lake Basin Joint Water Resource Board

The Joint Board has been extremely active in water management issues since the 1995 Water Plan was originally published. Since the 1995 plan was published, the Joint Board has worked extensively with various state, federal, and private agencies on a multitude of projects, both large and small.

The Joint Board has been involved in a myriad types of projects and studies, including: water quality, water storage, flood management, wetland inventories, the State Water Plan, sedimentation studies for several points along the south side of Devils Lake, and water control structure maintenance and improvements.

The Joint Board cooperatively funds a downstream outlet acceptance position, and an engineering position with the State Water Commission.

The Joint Board has worked extensively on securing funds for an exploratory study, and test project focusing on irrigation in the Basin. The purpose of the project is to determine the feasibility of using excess waters in the Basin to both improve the profitability of agriculture, and reduce the water reaching Devils Lake. The project is a

cooperative effort between the Joint Board, the federal government, and the State Water Commission. In 2005, construction began on ten test sites. Initial operations began in the fall of 2005. Full operation will begin in early 2006.

The Joint Board has been tremendously active in the last three years, including:

- Holding Sub-Basin Advisory Board meetings for all the organized sub-basins in the Basin.
- Working to analyze the potential for an east end outlet from Stump Lake into the Sheyenne River via the Tolna Coulee.
- Working with the State Water Commission on the Sweetwater-Morrison water storage project, storing up to 3,500 acre-feet of water.
- Working with the Bureau to keep the "Road & Railroad Crossing Inventory" of all of the major coulees in the Basin up-to-date.
- Providing technical and financial assistance to various organizations in their efforts to develop tours and educational programs in the Basin.
- Working to increase public knowledge about Confined Animal Feeding Operations (CAFOs).
- Instituting a "Devils Lake Basin Water Stewardship Award," which aims to award those people or organizations that have made a positive impact on water resource management in the Basin.

- Involved in a cooperative effort with the United States Geological Survey, the Red River Joint Board, and the State Water Commission to develop a trend analysis on water quality data collected on the coulees in the Basin.

- Developing a drainage moratorium in the Basin.

- Successfully requested an opinion on the “inundated acres” situation that is afflicting landowners around Devils Lake.

- In cooperation with the Red River Joint Board, convinced the 2005 North Dakota legislature to gain funding for the Grahams Island State Park Road raise, which kept the park open to the public

- Worked with the NRCS on the WRAS water quality study grant in 2001-2003.

- Taking the lead on examining options on how best to deal with the Billings Lake interbasin water transfer issue.

- Successfully lobbied to have a seat on the Devils Lake Outlet Advisory Committee.

Garrison Diversion Conservancy District

On December 22, 1944, Congress authorized the Flood Control Act, later named the Pick-Sloan Missouri Basin Program. The Act called for the construction of a series of massive main stem dams,



Figure 22. One of the two 2004 Water Stewardship Award Winners, students from Minnewaukan Public School.

power plants and other water control and management systems to manage the waters of the Missouri River for flood control, navigation, irrigation and hydroelectric power. It was out of this program that the Garrison Diversion Conservancy District was born.

While the Garrison Diversion Project as originally envisioned is no longer a viable option, the Garrison Diversion Conservancy District has played an active role in water development in the Basin, having spent nearly \$10 million to date, with \$100,000 for the City of Maddock to restore a 4-H building impacted by flooding, \$3,750 for a Beacon Light in Minnewaukan, and more than \$9,189,000 for Ramsey County Rural Utilities.

Natural Resource Conservation Service

The NRCS provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment. The NRCS maintains offices in the nine Basin counties. The NRCS provides conservation planning assistance to producers

in the Basin. It does this by meeting with landowners to explain and discuss the various conservation treatments and programs available, in order to counteract the negative economic and natural resource impacts that have been caused by years of flooding.

The NRCS has several programs that they administer, including the Federal Water Bank Program. In addition to these programs, the NRCS is active in educating landowners about the benefits of different types of agricultural practices, with the Sustainable Agriculture and Research Education (SARE) grant.

North Dakota Department of Health

The Health Department is committed to the protection and enhancement of the natural environment.

The Health Department Division of Municipal Facilities consists of four programs that help municipalities and other political subdivisions protect public health, safety, and the environment: the Public

Water Supply Supervision (PWSS) Program; the Operator Training, Certification, and Facility Inspections (OTCFI) Program; the Drinking Water State Revolving Loan Fund (DWSRF) Program; and the Clean Water State Revolving Loan Fund (CWSRF) Program.

The PWSS Program works with public water systems in North Dakota to ensure that drinking water meets all standards established by the Safe Drinking Water Act (SDWA). This is accomplished by monitoring for contaminants, providing operator training, reviewing plans and specifications, and providing technical assistance. The program also administers the state's fluoridation program and provides technical assistance to private water systems.

The OTCFI Program trains and certifies persons in charge of the day-to-day operation of drinking water and wastewater facilities. Inspectors/trainers annually inspect public water and wastewater systems to ensure that facilities comply with state and federal public health standards and are properly operated and maintained.

The DWSRF Program provides low-interest loans to assist public water systems finance the infrastructure needed to comply with the SDWA. Eligible borrowers can obtain financing to construct needed water facilities at below-market interest rates. The DWSRF Program also conducts technical reviews of drinking water projects. The reviews ensure that new or modified public water facilities meet state design criteria before

construction, achieve the desired public health objectives, and can be properly operated and maintained.

The CWSRF Program provides low-interest loans to fund conventional wastewater and non-point source pollution control needs. Like the DWSRF, eligible borrowers can obtain financing at below-market interest rates to build needed wastewater facilities and fund non-point pollution control projects. Also, the CWSRF Program conducts technical reviews of wastewater projects.

With respect to protection of groundwater and surface water quality, these programs collectively function to ensure that water and wastewater facilities throughout North Dakota are properly designed, operated, and maintained so that residuals from these facilities meet all applicable standards prior to release to any waterway or land. Recent projects within the Devils Lake drainage basin which illustrate this function include: force main replacement and rehabilitation of the city of Warwick's wastewater lagoon; and improvements to address treatment residuals handling and correct uncontrolled discharges from the lime sludge pond at the Langdon Water Treatment plant.

The Division Of Water Quality continues to monitor the Devils Lake chain of lake four times per year. The parameter list is extensive including chemical, physical, and biological components. Special studies are initiated on a as needed basis.

North Dakota Department of Transportation

The DOT has a mission statement of providing a transportation system that safely moves people and goods. DOT has spent over \$100 million on improvements and maintenance for roads affected by the rise of Devils Lake. Generally, the roads have been raised to an elevation of 1,455 feet amsl, with the base wide enough to eventually go to 1,465 feet amsl and the bridges to 1,465 feet amsl. The Department of Transportation recently began re-routing U.S. Highway 281, in order to avoid further flooding problems, and has been working with the Water Commission on State Highway 20, which runs along the Spirit Lake Reservation, and is being threatened by flooding-related problems as well.

North Dakota Forest Service

The North Dakota Forest Service (Forest Service) administers forestry programs statewide. Technical assistance relating to the management of private forest lands, state forest lands, urban and community forests, tree planting, and wildlife fire protection is provided by the Forest Service. The Forest Service also owns and manages approximately 13,278 acres of state forested lands. The Forest Service conducts regular surveys

of Devils Lake to determine the amount of acres of forest inundated since 1995. In 2005, the Forest Service also began monitoring forested lands being inundated by Stump Lake's rapid rise.

North Dakota Game and Fish Department

The North Dakota Game and Fish Department (Game and Fish) has and continues to do a great deal of work in the Basin. Game and Fish maintains an active sports fishery on Devils Lake, and also plays an active role in providing and maintaining angler facilities such as boat ramps, and parking lots. The Game and Fish is also active in the development of land devoted to wildlife production, through programs such as the Private Land initiative (PLI) for the counties in the basin, and is still expanding the program. The Game and Fish has also funded work done through the Agriculture Department in the basin, in regards to the State Waterbank Program.

In late 2004, Game and Fish, at the request of the Joint Board, began assist the Joint Board and Water Commission on the Billings Lake biota transfer issue. Game and Fish is very concerned about the potential for carp, and the potential for other exotic aquatic species to make their way into the valuable Devils Lake fishery.

Game and Fish funded approximately \$100,000 in improvements and enlargements of facilities at Black Tiger Bay.

North Dakota Natural Resources Trust

The North Dakota Wetland Trust was established as part of the Garrison Diversion Unit Reformulation Act of 1986.

The purpose of the Trust is to preserve, enhance, restore and manage wetlands and associated wildlife habitat. In 2000, Congress enacted the Dakota Water Resources Act, that renamed the Wetlands Trust to the Natural Resources Trust and expanded the Trust's mission beyond wetlands and associated upland habitat to include conservation of grasslands and riparian areas in North Dakota. The Trust has done a lot of work in terms of wildlife and fisheries habitat, and also for sustainable agriculture.

The Trust has also developed a demonstration program, the Grand Harbor Watershed Management Project, which has taken nearly a half mile of land in the Basin, and developed and maintained it with the goals of meeting the needs of all interests; agriculture, wildlife enthusiasts, sportsmen, and the various levels of government. In total, the Trust has restored over 21,000 acres of land in the Basin for various types of habitat, including 6,229 acres of wetlands, with 12,025 acres of uplands, and 9,214 acres of conservation tillage. The Trust has also funded soil testing for nutrient management on 5,907 acres, provided registration and travel for farmers to attend regional no-till meetings. The Trust is working with over 350 producers, and has spent over \$1,500,000 on these projects.

North Dakota Parks and Recreation Department

The North Dakota Parks and Recreation Department (Parks and Recreation) is involved with maintenance and enhancement of the three state park facilities in the basin: Grahams Island, Shelters Grove, and Black Tiger Bay. Parks in the Basin have been plagued by access issues, as water continued to rise. Despite these challenges, Parks and Recreation has worked to relocate recreational structures to keep ahead of rising water. Because of their work, park access in the basin has been reduced by the current wet cycle, but not eliminated. Parks and Recreation has spent \$570,000 in the maintenance of their facilities due to the rise of the lake.

North Dakota State University Extension Service

The NDSU Extension exists to serve the people of North Dakota. The Cooperative Extension System was established in 1914 to address through education the critical needs of the public in the areas of agriculture, family and youth. The work of the NDSU Extension continues to be extremely important to producers, families, community leaders and young people. Extension maintains a unique relationship among federal, state and county constituents. Local input into programs, combined with support and funding from state and federal partners,

enables the Extension Service to truly meet the needs of people.

The NDSU Extension is active in disseminating knowledge about sustainable land use practices in North Dakota. While the NDSU Extension does not break down their projects to the basin level, their efforts have been integral in increasing the amount of land that is used for conservation tillage, and encouraging alternative crops that are more suited to the current conditions in the basin.

North Dakota State Water Commission

The Water Commission's mission is to assist in the implementation of the three-pronged approach to solving the flooding problem on Devils Lake. The Water Commission has comprehensive water management in North Dakota as its primary goal.

The Water Commission has spent \$3,500,000 on both the ASAP and ESAP programs in the Basin, which paid landowners in the upper basin to store excess water on their land. The ASAP program stored 8,000-22,000 acre-feet per year. In 2000, ASAP evolved into the Extended Storage Acreage Program (ESAP,) which involved extended (typically ten-year, rather than one-year) contracts. Under ESAP, the SWC signed contracts for eight sites in 2000, which covered 395 acres, and had an approximate storage volume of 800 acre-feet. Those contracts are scheduled to expire on December 31, 2008. In 2003, an additional ESAP contract was signed for 18 acres, with 35 acre-feet of storage.

That contract will also run through December 31, 2008.

The Water Commission has also co-funded a Bartlett and West Engineering study with the Joint Board on the feasibility of irrigation as a means of lowering lake levels, and enhancing crop production in the Basin. The Water Commission has also played an integral role in assisting and coordinating efforts with the Joint Board to develop and update the Water Plan and other water management projects. In 2004, the Water Commission provided \$302 thousand in funding for an irrigation test project in the basin, and provided technical assistance as well.

The Water Commission has also conducted extensive research of potential groundwater drinking water supplies for the City of Devils Lake.

The State of North Dakota is pursuing a phased implementation outlet project limited by water quality and quantity constraints from West Bay on Devils Lake to the Sheyenne River. The first phase of the project can pump up to 100 cubic feet per second, with the potential for expansion to 200 or 300 cfs later, although this would require re-permitting the project. The outlet consists of two pumping stations, 3.3 miles of pipe, and 9.4 miles of open channel. The project will utilize existing U.S. Army Corps of Engineers EIS studies, and a Council on Environmental Quality-directed biota study to assess potential downstream impacts. The final design for the entire project has been completed. Construction began in 2002, and was completed

in late-summer 2005. The construction of the 100 cfs outlet cost approximately \$28 million, with an annual operation and management cost of approximately \$1 million. In late 2005, last minute agreements with the Council on Environmental Quality resulted in a gravel filter to minimize the concerns of Manitoba and Minnesota being included. The Water Commission has also developed an Erosion Mitigation Plan in order to deal with recognized concerns of downstream landowners regarding the potential for erosion resulting from the operation of the outlet.

The Water Commission also cooperatively funded a full-time engineering position with the Joint Board. Through this position, the State Water Commission is continually involved in just about every major water resource issue in the basin, considering a variety of topics, including water storage, water management, structural investigation, and many others.

United States Army Corps of Engineers

The Corps, St. Paul District, serves the citizens of the Basin in the areas of environmental enhancement, flood damage reduction, wetland regulation, recreational sites and disaster response. The Corps has spent millions of dollars studying the feasibility of and impacts from the Devils Lake emergency outlet. In pursuance of that goal, the Corps has completed or funded studies on water quality, upper basin water storage, water management, flood management,

wetland inventories, sedimentation, outlet alternatives, biological inventories, cultural impacts, demographics, economic feasibility of various project options, hydrology, soils, public surveys, mitigation, Geographic Information Systems (GIS) analysis of the basin, and planning.

Since 1998, approximately \$50 million has been spent by the Corps, the State of North Dakota, and the City of Devils Lake to raise the dike system protecting the City of Devils Lake. With the completion of the 3-foot raise currently under construction, the dike will have a top elevation of 1,460 feet amsl, and be approximately 8.3 miles in length. The dike protects the City up to lake elevations of 1,454 feet amsl. The dike begins on the west side of Devils Lake near the airport, goes around the south end, and comes out by Highway 2, near Mertens Lake View Dairy.

United States Fish and Wildlife Service

The Fish and Wildlife Service is part of the Department of the Interior. The Fish and Wildlife Service is responsible for carrying out federal laws and programs that conserve fish, wildlife, and their

habitats. The Fish and Wildlife Service has major responsibilities for migratory birds, endangered species, some marine mammals, and freshwater and anadromous fish.

In the Basin, the Fish and Wildlife Service manages the National Wildlife Refuge System including easement and fee title tracts, and administers the Federal Aid in Sport Fish and Wildlife Programs. An important facility is the Sullys Hill National Game Preserve, which is part of the National Wildlife Refuge System. Sullys Hill receives 38-43,000 visitors annually.

In addition to managing Sullys Hill, the Fish and Wildlife Service actively acquires land through fee title and easement, and manages wetlands for the dual purposes of water storage and wildlife/waterfowl production, including the Lake Alice Refuge. In total, the Fish and Wildlife Service has completed numerous wetland management projects within the Basin, totaling 6,433 acres in area, with potential to store 9,252 acre-feet of water, and has over 20 additional projects planned that would total 5,086 acres in area, with 9,713 acre-feet in storage, which would bring the total to 11,354 acres, with 18,843 acre-feet in storage. The Fish and Wildlife Service has also done work on a bird watching trail in the Basin.

United States Geological Survey

The USGS serves the nation by providing reliable scientific information to describe and understand the earth, minimize loss of life and property from natural disasters, manage water, biological, energy, and mineral resources, and to enhance and protect our quality of life.

The USGS has played a vital role in the study of various hydrogeological aspects of the Basin. In all, the USGS has completed nearly 50 studies, or papers, on the hydrogeology of the Basin, and their work is vital in keeping decision-makers informed with the best, most up-to-date information. The USGS also is involved in stream gaging and water quality monitoring in the basin.

The USGS is involved in a cooperative effort with the Joint Board, the Red River Joint Board, and the State Water Commission to develop a trend analysis on water quality data collected on the coulees in the basin. The United States Geological Survey is also working cooperatively with the State Water Commission on water quality gauging stations in Round Lake, and at various points in the Sheyenne River, to support the requirements of the Devils Lake outlet.

Devils Lake Basin Background

Even before European settlement began in the region, Devils Lake represented a geographic focal point. The availability of water, food, and game on the shores of the lake supported the First Nations Peoples (Spirit Lake Nation and other tribes) and was a magnet to early European settlers. As additional land opened for settlement through various acts of Congress and as transportation improved, rural communities began to

emerge. The land was gradually converted from prairie and wetlands to farmland.

The relatively flat topography, dramatic swings in climate; abundance of prairie potholes, and conversion of land has led to a variety of water management conflicts over the years. More recently, the most serious concerns have related to the

flooding of agricultural lands and public infrastructure, the preservation of wetlands and other wildlife habitats, water quality and the viability of the Devils Lake fishery, along with the recreational industry it supports.

Many aspects of the geography, land use, water quantity, water quality, and social issues of the Basin are unique to the area. Knowing the background of the basin will help to focus the Water Plan towards those needs that are the most imperative.

Geography

The Basin is located in north-eastern North Dakota and covers a total of about 3,814 square miles (2,440,960 acres) containing all or portions of nine counties, a small portion of the Turtle Mountain Chippewa Reservation, and a large portion of the Spirit Lake Sioux Reservation.

The basin is a typically non-contributing portion of the Red River of the North's drainage area, but under prolonged conditions of precipitation exceeding evapotranspiration, or extreme precipitation events, it becomes seasonally contributing.

There are nine sub-basins within the Basin. Most of the sub-basins are connected via natural coulees. The Edmore, Starkweather, St. Joe, and Calio Coulees originate in southern Cavalier County and flow in a south-southwesterly direction. Mauvais Coulee originates along the southern flanks of the Turtle Mountains 300 to 400 feet above the elevation of Devils Lake and enters Big Coulee at Lake Irvine.

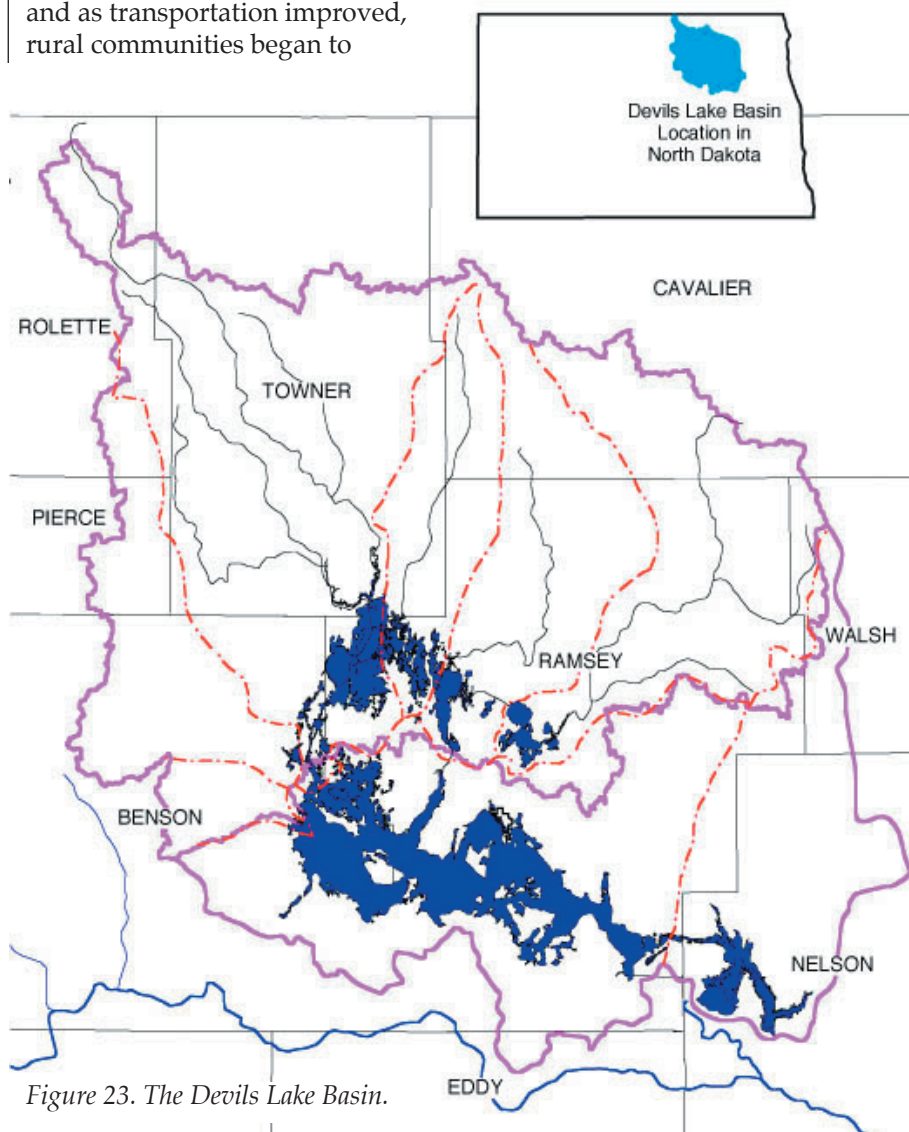
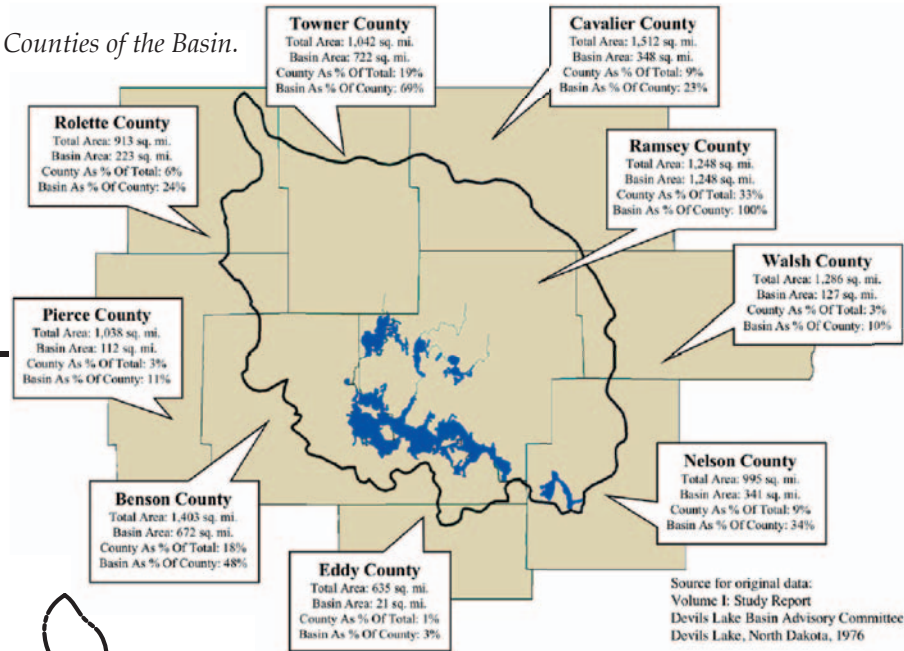


Figure 23. The Devils Lake Basin.

Figure 24. Counties of the Basin.



Big Coulee flows from Lake Irvine into Devils Lake's West Bay. Little Coulee serves about 421 square miles on the west side of the basin and joins Big Coulee approximately 5 miles south of the now defunct town of Church's Ferry.

Upper Basin Lakes

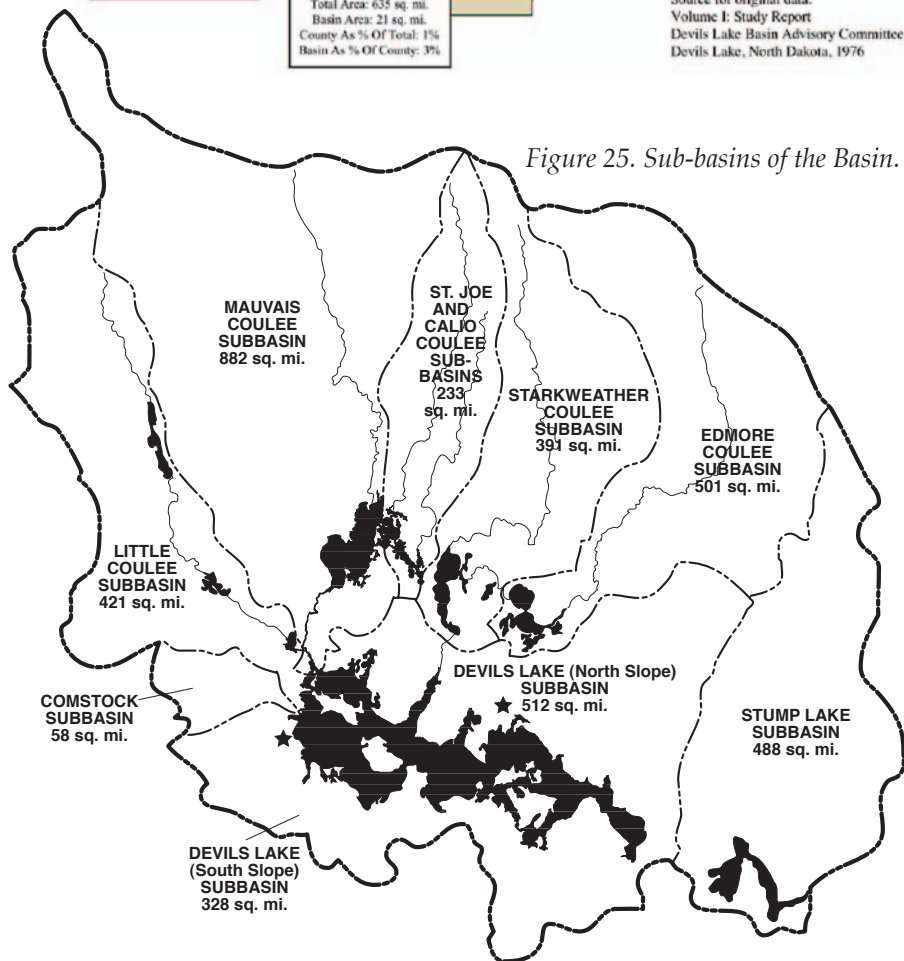
Physiographically, the basin lies within the Central Lowlands Province, an area of glacial drift and lacustrine plains formed by the continental ice sheets during the latter part of the Wisconsin glacialiation in the Pleistocene Epoch. The glacial drift ranges from a few feet to over 300 feet in thickness.

Topography in the region is glacial in origin; low hills and flat lands are typical. Many depressions, wetlands, and small lakes occurring in the basin are connected via poorly defined drainage systems. During prolonged wet cycles or extreme precipitation events, these areas can overflow and contribute water to Devils Lake, and under extended wet cycles may actually flow to the Red River Basin.

A multitude of studies confirm that the chain-of-lakes are an important factor affecting the flow of water into Devils Lake. The chain of lakes upstream of Devils Lake can act as storage and evaporation basins that ultimately affect flows throughout the system. These effects are evident in water volume and, under certain circumstances, can be a factor in improving the quality of water that enters Devils Lake.

The creation of the Fish and Wildlife Service in the early part

Figure 25. Sub-basins of the Basin.



of the 20th Century added a new factor to water movement. The evolution of those interested in production of wildlife and its associated values, and an awareness of the importance of water quality, further added to the complexity of the issue.

Prior to 1979, runoff from the basin tributaries flowed into the interconnected chain of lakes and discharged through Big Coulee (Lower Mauvais) into Devils Lake. During the period from 1993 to the present, conditions of high precipitation, coupled with a low rate of evapo-

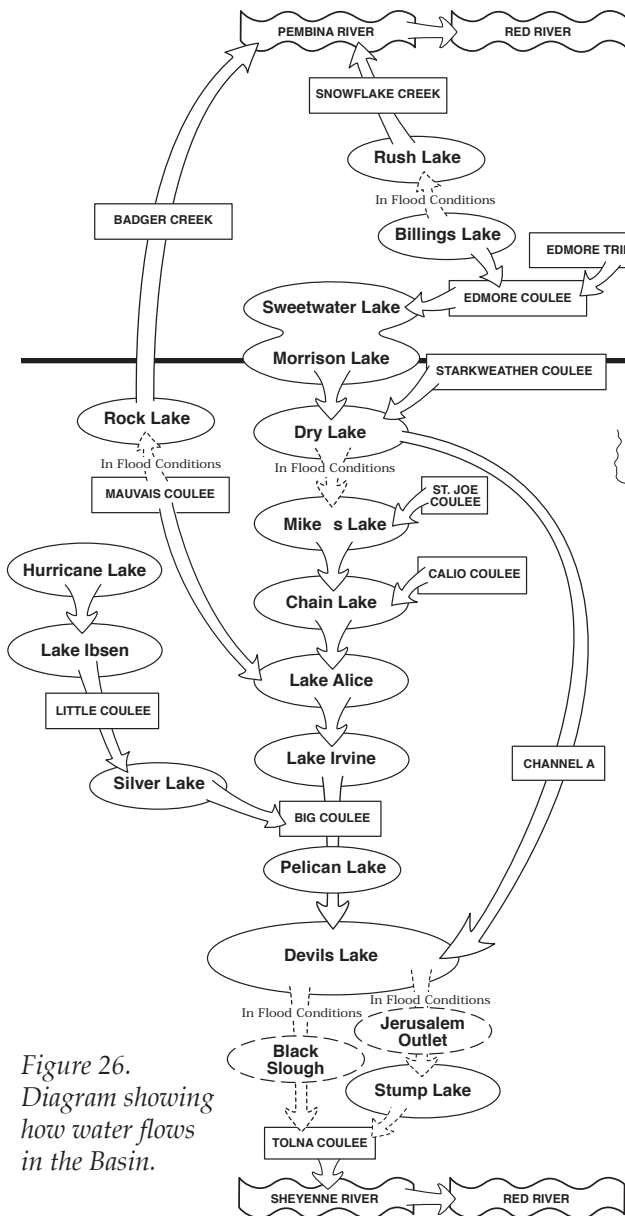


Figure 26.
Diagram showing
how water flows
in the Basin.

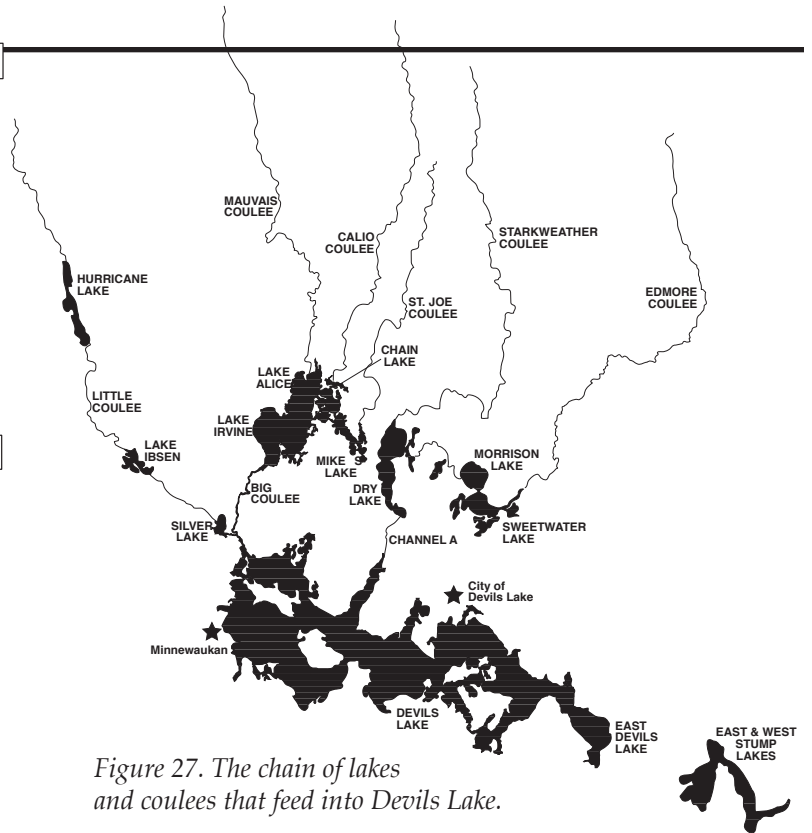


Figure 27. The chain of lakes
and coulees that feed into Devils Lake.



Figure 28. Channel A in 2003.

transpiration have led to increased overland water flow through the various coulees that ultimately feed into Devils Lake.

Channel A, which connects Dry Lake to Six Mile Bay (Devils Lake), began operation in 1979 as a flood control project protecting

agricultural lands and the transportation system. The construction of Channel A and a levee across the natural outlet of Dry Lake divided the drainage pattern of the basin into two sub-basins. Now, except for unusually large runoff events, runoff flowing through Sweetwater,

Morrison, and Dry Lakes discharges down Channel A directly into Devils Lake, as opposed to flowing through Chain Lake, Lake Alice, Lake Irvine, and Big Coulee first. Runoff from the remainder of the watershed discharges along the natural watercourse down Big Coulee (Lower Mauvais) into Devils Lake.

The upper basin lakes are meandered lakes. "Meandered lake" means any pond, slough, or lake which has had its boundaries established by metes and bounds in the survey of public lands by the government of the United States. The meander lines were established by the original United States government survey in the early 1880s. Surveyors, using "metes and bounds," determined where the

property lines around lakes were drawn. This was necessary in the determination of a settler's total of 160 acres of land for homestead rights. The survey reflects conditions at that time. Meander lines are not an indication of a "normal" lake level, nor do they imply that land beyond that line will not be flooded periodically.

Historically, lake levels have been controlled by runoff conditions and the natural overflow elevation. The natural overflow elevation is the level at which the lake overflowed prior to tampering by man. This elevation may change over time due to erosion and sedimentation. Lowering a lake below its natural overflow elevation would require a drain permit. The State Engineer and the County Water Resource Districts jointly administer the drain permitting process. In the case of a meandered lake, the State Engineer would make the final decision on an application to drain.

The Joint Board manages the outlet controls at Sweetwater-Morrison Lake, and Dry Lake is managed by an agreement among the Ramsey and Cavalier County Water Resource Districts, and the Water Commission. The Water Commission has granted the Fish and Wildlife Service a permit to hold Lake Alice at 1,443 feet amsl. The Fish and Wildlife Service has developed a water management plan for the Lake Alice National Wildlife Refuge. This plan consists of 11 managed pools that total over 7,700 acres and stores 9,883 acre-feet of water. To date, the Fish and Wildlife Service has completed



Figure 29. The Sweetwater-Morrison outlet control structure in 2005.

several of the Lake Alice wetland development projects, totaling almost 4,400 acres and storing 3,394 acre-feet of water. Completing the remainder of these projects would provide valuable water storage, water management, wildlife habitat and recreational potential. In 2004, the five-year water storage contracts were renewed with the 30 landowners on Sweetwater-Morrison with five-year contracts. Also in 2005, the Joint Board, in consultation with Game and Fish and the Water Commission, examined the benefit of storing an additional foot of water in Sweetwater-Morrison through the winter of 2004-2005. It was thought that storing that additional water would reduce the chance of a "winterkill" of fish in the Sweetwater-Morrison lakes.

Mikes Lake has a control structure, but it is beneath the current elevation of the lake. The other upper basin lakes, Chain, and Irvine, do not have specific operating plans at this time.

Devils Lake

The most prominent feature of the basin is Devils Lake, the largest natural lake in North Dakota. Devils Lake is located in the southern portion of the basin and collects runoff water from 86 percent of the contributing portions of the

basin. The remaining 14 percent of the basin flows into Stump Lake, located in the southeast portion of the basin.

Devils Lake is a shallow, saline (salty,) hypereutrophic (very high nutrients) lake under extended dry conditions, but under the current extended wet cycle, relatively deep (nearly 60 feet in places), sub-saline (variable amounts of soluble salts), eutrophic (rich in nutrients, minerals, and organisms). Water levels have varied widely over time, dependant largely upon long-term hydrologic / climatic conditions. Data from many study initiatives over the last 100 years do not reach definitive conclusions about why the level of Devils Lake varies so dramatically.

Interbasin Water Transfer

The Basin has had several documented actual or potential points at which water naturally flows to the Red River Basin under extreme precipitation events.

The Devils Lake Basin is very flat, due to the lack of time that forces such as erosion have had to cut channels into the landscape. These level areas cause water to pool, and sometimes flow one way or the other, depending on conditions such as rainfall or snow amounts, vegetation, and wind.

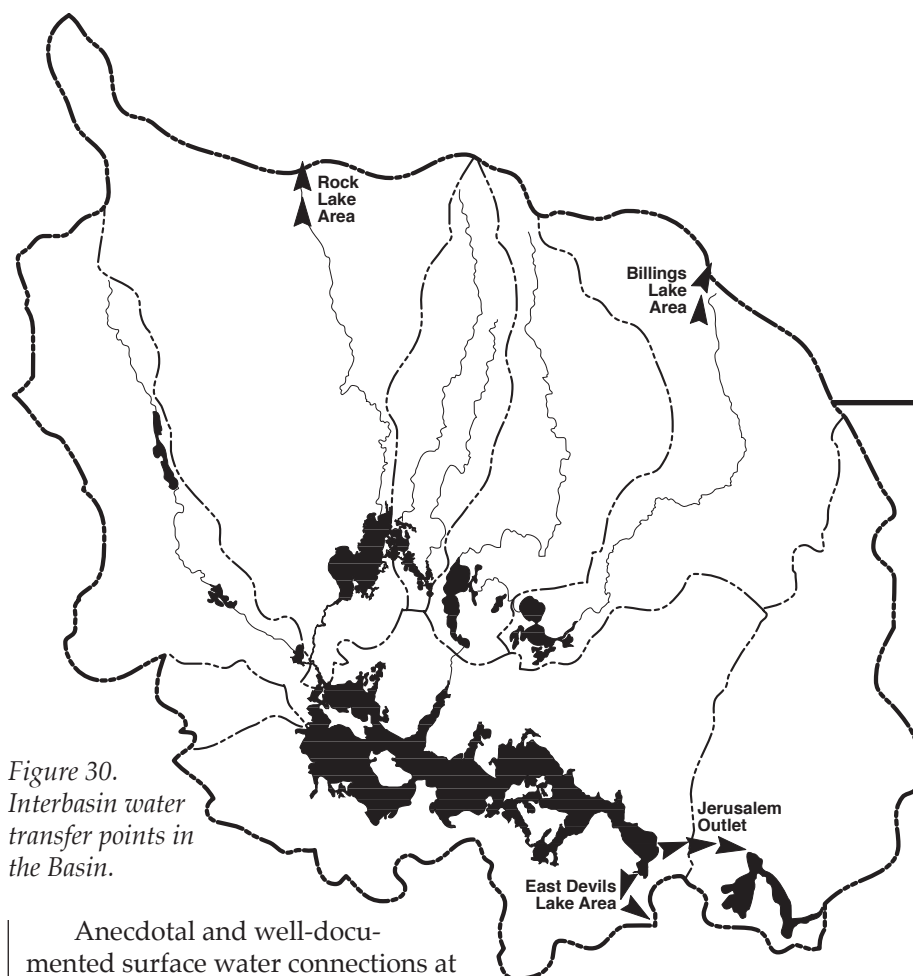


Figure 30.
Interbasin water
transfer points in
the Basin.

Anecdotal and well-documented surface water connections at four specific locations between the Basin and the Red River basin occur through poorly defined drainages such as this, including: Rock Lake, McHugh Slough, Black Slough, and Billings Lake. The most thoroughly documented connection occurs north of Billings Lake, near the town of Nekoma in the southern portion of Cavalier County. Billings Lake feeds into the Edmore Coulee, and eventually into Devils Lake. However, in 1997, 2003, 2004, and 2005, water was documented to have been flowing north over the divide, between the Basin and the Pembina River Basin. In 2003, the water was flowing for about a month, after a relatively dry winter in the basin. In 2004, the water flowed also for a month, and the Water Commission estimated the water flow to be approximately 15 cfs, or 15 percent of the maximum discharge of the state outlet. From data gathered in this area, it appears that under somewhat wet conditions, water is pooled in a wetland complex in this very flat area, which then flows

south into Billings Lake, and also, north, across the basin divide, into Rush Lake, then Snowflake Creek, the Pembina River, the Red River, Lake Winnipeg, and eventually into Hudson Bay. The significance of this connection and others like it is that it contradicts the belief that Devils Lake has been isolated from the Red River basin for thousands of years. As a result, any fish, plant, aquatic insect, or pathogen found in the Basin, would have had ample opportunity to move across the divide into the Red River, and vice-versa. In fact, Game and Fish is monitoring areas such as Rock Lake, to ensure that carp do not make their way into Devils Lake from the Red River. Because of concern over this issue, the Joint Board, working closely with Cavalier County, and various state and federal agencies, began the process of examining alternatives for how to prevent carp from entering Devils Lake and wreaking havoc upon the multi-million dollar fishery.

Water Use

Contentious water issues have plagued the Basin since the area was settled in the late 1890s. Excess water creates problems when it inundates properties from which economic returns are expected. These problems compound if natural flows have been altered.

Alteration of flows started before the advent of power machinery, as we know it today. Testimony in the court report of 1957, the Upper Lakes Farmers versus the United States, details an attempted channel clean out using hand shovels and later horse drawn equipment. As agriculture obtained more sophisticated equipment, the movement of excess waters off the land was accelerated.

The lake region community desires to stabilize Devils Lake water levels to maintain or improve the local economy, and the local economy is highly dependent on water-based recreational activities. The lake region community desires to sustain the recreational resources of Devils Lake, especially as a fishery. The Spirit Lake Nation wants to also maintain or enhance certain qualities of Devils Lake for spiritual reasons. Recreational interests want to implement important watershed management conservation measures, which will also improve the upper basin for recreational purposes, along with flood mitigation features, and also want the water that enters Devils Lake to be as clean as possible.

Draining water off of farmland is often seen as being in the best interests of agricultural interests because it maximizes production of

crops. Water sports enthusiasts and lakeshore residents want a stable water level. The fishing community wants a water level and quality that will sustain their fishery. Many agriculturalists reason that with the advent of soil tillage, the amount of wetlands was increased. They adamantly oppose strict regulations that stop certain management activities on their lands such as consolidation of wetlands. Alternately, many wetland conservationists are strongly in support of any actions that prevent or restrict such practices.

The presence of the Fish and Wildlife Service refuge, in conjunction with upstream drainage, on and around Lake Alice, has resulted in some conflict in the upper lakes area. The objectives of agricultural interests and the objectives of the Fish and Wildlife Service are sometimes opposed to one another.

The Fish and Wildlife Service and the agriculture interests in the chain of lakes area are unhappy about the amount of uncontrolled waters entering their area. The Fish and Wildlife Service is not able to carry out their mission because of unpredictable water levels. Agricultural land is continually being inundated by water that does not drain off quickly enough.

Those interested in maintaining the values of wetlands want to retain, or slow the movement of water in the basin for the production of wildlife. Wetland scientists have demonstrated that wetlands recharge ground water, provide wildlife food sources and habitat, provide some degree of downstream flood control, improve

water quality, decrease erosion, provide for scientific study and education needs, increase recreation, and provide economic diversity.

Devils Lake is of great spiritual significance to the Spirit Lake Nation. Peter Belgarde, former Chairman of the Spirit Lake Nation says, *"The waters of Devils Lake serve as a symbol of hope for the people of the Sioux Tribe. Devils Lake is a prominent fixture of the Devils Lake Sioux past. There is healing power at certain parts of the lake. Herbs, roots, leaves, and barks have medicinal powers."* Belgarde continues, *"I believe there is a connection between the spiritual presence of Devils Lake and my people."*

The wide variety of goals of these diverse interests in the Basin, highlights the need for a comprehensive water management plan and the need for local solutions to local issues. In order to begin resolving some of these dilemmas, it is important that these groups set aside their differences, and begin to work for the betterment of the Basin.

Land Use

Agriculture, natural resources, and recreational are the three primary components of the land use in the Basin. The challenges facing the people of the Basin are diverse and complex, both scientifically and politically. Within the Basin, there are three primary goals for land use. These include:

1. Agriculture
2. Conservation, Wildlife, and Fisheries
3. Alternative Uses and Benefits

Agricultural use of the landscape is the best-suited use on most of the soils and is important for economic prosperity in the Basin. Wildlife production and habitat development are land uses that the Basin is well suited for, due to a combination of factors. Alternative uses and benefits refer to practices such as urban development, flood-water storage, and tourism.

Agriculture

As Europeans began to settle the region, native mixed grass and tall grass prairie were plowed, and wetlands were drained. In 2000, cropland accounted for approximately 59 percent and rangeland, CRP and hay land accounted for an additional 21 percent of the basin's land cover. The main economic activity in the basin is derived from cropland.

Economic pressures, new or revised state and federal laws and programs, weather problems, demographic shifts, and other factors, have changed the face of agriculture in North Dakota. In the Basin, much like the rest of the state, the number of farming operations is down and remaining farm sizes are up. In 1997, those counties that comprised the Basin had a total of 4,755 farms, with 5,518,615 acres in farms, and the average size of a farm was 1,170 acres. In 2002, those counties that comprised the Basin the number of farms increased to 4,984, there was about 100,000 acres less land being farmed at 5,414,621 acres, and the average size of a farm had decreased slightly to 1,107 acres. There were over 721,524 acres enrolled in the Conservation



Figure 31. The sun setting on Devils Lake, just south of Grahams Island State Park in 2003.

Reserve Program (CRP) in those counties that comprise the Basin, as of 2005. This number is up dramatically from the 25,361 acres of CRP that were enrolled in the Basin counties in 1991. The basin provides a diverse landscape, which appeals to many different types of natural resource users. An analysis of land use and cover, using Landsat satellite imagery from 2000, shows the approximate acreages for the following land cover types; 59 percent cropland, 21 percent pasture / range / CRP / Non-Ag, 0.65 percent woodland, 7 percent water, 11 percent fallow / idle cropland, 1 percent urban, and less than 1 percent other. The thousands of acres of rich agriculture lands are dotted with hundreds of wetlands that attract the attentions of those interested in wetland values.

Conservation, Wildlife, and Fisheries

The Basin lies in the drift prairie region, and is characterized by numerous shallow potholes. This prairie pothole region of the United States is of significant importance to waterfowl populations. The Basin is located in the center of the Fish and Wildlife Service Devils Lake Wetland Management

District. This complex of lands includes the Lake Alice National Wildlife Refuge, Sullys Hill National Game Preserve, and thousands of acres of waterfowl production areas (in public and private ownership). It is estimated that a significant amount of waterfowl production in North Dakota took place in the eight counties that comprise the Fish and Wildlife Service Devils Lake Wetland Management District. In addition to waterfowl, the Basin also provides habitat for deer, furbearers, sandhill cranes, upland game, and many non-game species of wildlife.

The Basin landscape, being very rich in natural resources, hosts a multitude of wetlands, woodlands, and grasslands that provide necessary habitat for many species of wildlife.

The wetlands of the basin are located directly in the Central Flyway and are some of the nations best waterfowl and other migratory bird staging, nesting, and production areas.

The Devils Lake area also represents one of the three most important remaining areas of natural woodlands in North Dakota. The woodlands along the south shore; the Lakewood area on Creel

Bay; the Sullys Hill National Game Preserve, on the Spirit Lake Nation Reservation; and at Grahams Island State Park are unique in North Dakota due to a scarcity of natural woodlands. Woodlands are important as wildlife habitat, for wildlife-oriented recreation, and for aesthetics as well. An aerial survey conducted by the Forest Service estimated that there were 3,876 acres of forest impacted by the rise of Devils Lake to 1,446 feet amsl. In 2005, the Forest Service also began monitoring forested lands being inundated by Stump Lake's rapid rise. Thirteen acres will be flooded when the lake's elevation reaches 1,436 feet amsl.

The grassland acres of the basin occurring on public land and on private lands, composed of rangeland, hay land, and CRP, are critical to many migratory and resident game and non-game species for nesting and feeding sites.

Alternative Uses and Benefits

The Basin offers diverse, high quality, outdoor recreational opportunities. The attractiveness and natural diversity of the area has led to the development of recreation as an important contributor to the economy of both the region and the state.

Demand for recreation was identified in the 1991-1995 Outdoor Recreation Plan (1990). Walking, bicycling, gardening, hiking, open water fishing, camping, jogging, boating / water skiing, horseback riding, and beach swimming were the top ten activities on the basis of per capita days of participation.

Total direct expenditures by hunters and anglers in North Dakota during the 2001-2002 season, were estimated at \$468.5 million, excluding purchases of licenses. Resident hunter and angler expenditures were \$402.7 million and nonresident hunter and angler expenditures were \$65.9 million. The 2001-2002 season generated nearly \$544.9 million in secondary economic effects. The gross business volume (direct and secondary economic effects) of hunting and fishing in North Dakota was estimated at \$1 billion.

Other outdoor recreation such as boating, skiing, swimming, canoeing, camping, picnicking, and sight-seeing exceeded one million user days of participation in 1990 and is expected to experience similar growth by the year 2000. These numbers reflect a change in recreational usages in North Dakota, with sightseeing seeming to be gaining in importance as opposed to anglers, with some sightseers coming specifically to view the flooding situation.

Devils Lake also supports a nationally recognized sport fishery. The lake has been host to many fishing tournaments, including the nationally known events such as the Cabela's Tournament, the Pro Walleye Tour circuit, and the Wal-Mart "RCL" Tournament. Angler activity reached 156,000 angler days in the summer and 116,000 angler days in the winter in 1993. Ice angling is also popular on Devils Lake, but the majority of this group came from out of state, with nearly 70 percent coming from either

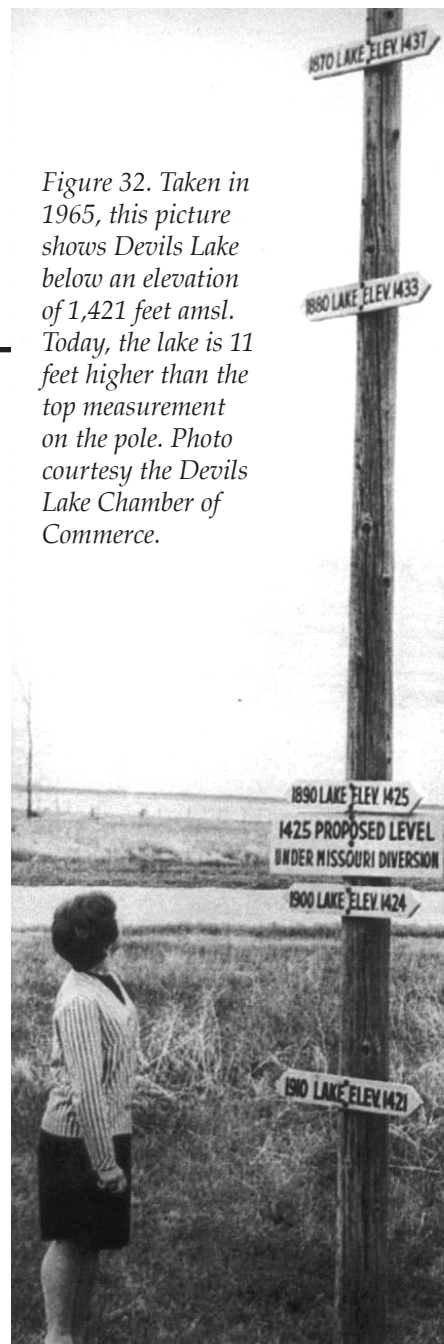
Wisconsin or Minnesota. On Stump Lake, ice fishing accounted for over 6,000 angler days and 2,600 angler trips. In recent years, as the elevation of Stump Lake has continued to rise, and the water quality has continued to improve, the fishery in the lake has improved as well.

The potential to utilize the environment as a resource in terms of economy, has not yet been fully realized. As stated in some sources, North Dakota is the least visited state in the country, however it has enormous natural resource economic opportunities.

Waterfowl Production Area's preserve wetlands and other wildlife habitat. These lands, administered by the Fish and Wildlife Service, became part of the National Wildlife Refuge System in 1966. Nearly 95 percent of Waterfowl Production Area's are located in the Prairie Pothole Region and the Basin is in the heart of the prairie pothole region. These areas provide virtually thousands of acres of habitat that not only increase the tourism draw for hunters and outdoor enthusiasts, but they are also sites for flood storage and water quality improvements.

Despite rising water levels in the lake, the Devils Lake area could be developed as a flagship of visitor destinations in North Dakota, the "Detroit Lakes of North Dakota." The key to the community's success is a concerted, collaborative effort by local landowners, elected officials, farm groups, the business community, the Spirit Lake Nation, assisted by state and federal agencies.

Figure 32. Taken in 1965, this picture shows Devils Lake below an elevation of 1,421 feet amsl. Today, the lake is 11 feet higher than the top measurement on the pole. Photo courtesy the Devils Lake Chamber of Commerce.



Water Quantity

Many contentious issues surround water quantity and water management in the basin. Some landowners desire to drain wetlands and move water, especially from their cropland, to increase their economic returns through increased crop production on soils that can be very productive when dry, and especially to make it easier to utilize large farm machinery.

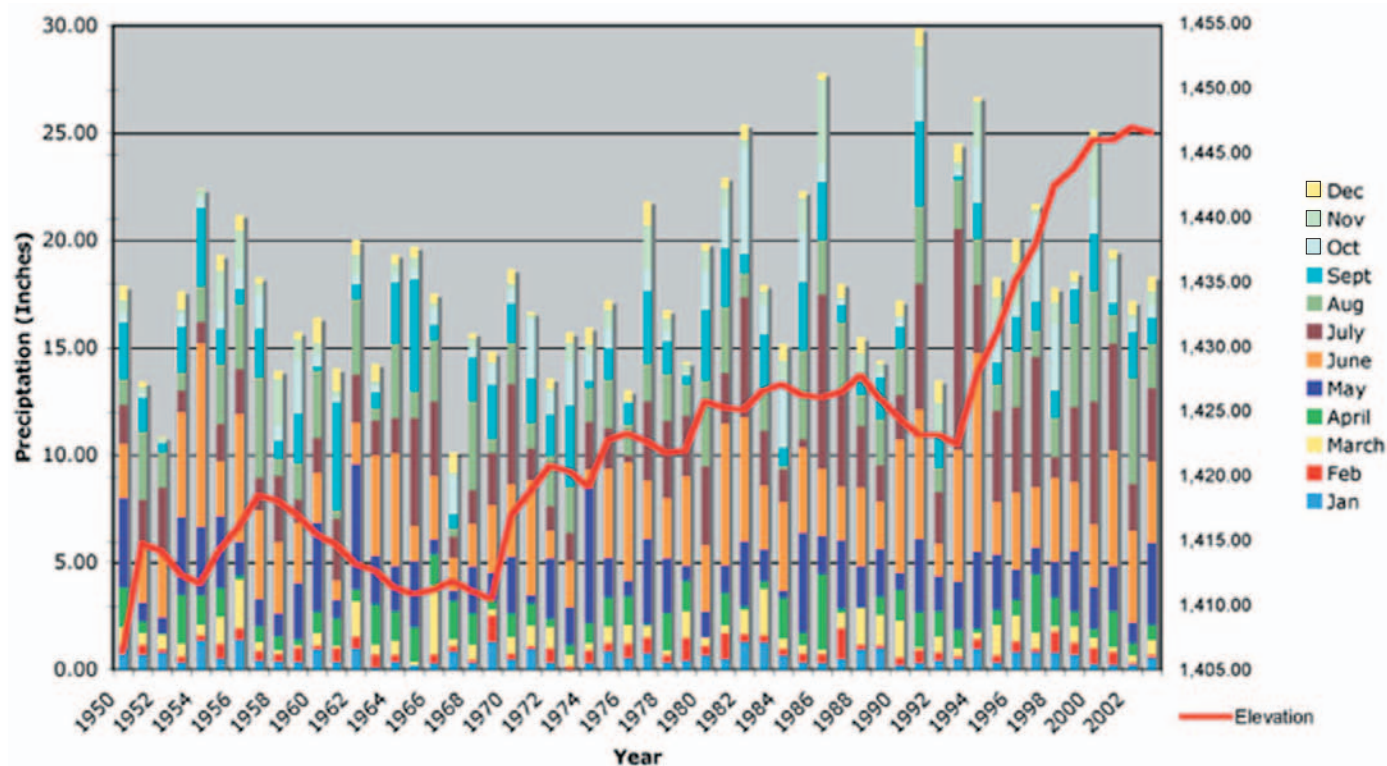


Figure 33. Devils Lake Precipitation (1950-2003), showing the relationship between the amount of precipitation by month and lake elevation.

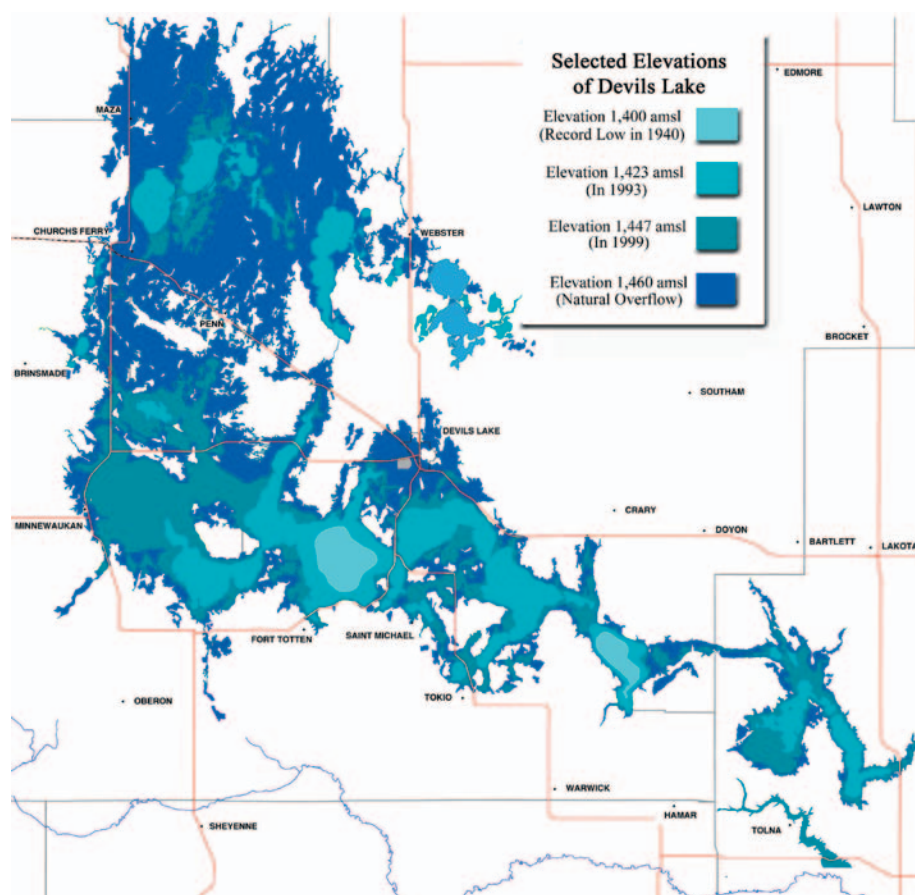


Figure 34. Selected elevations of Devils Lake.

In 1895, Warren Upham of the USGS estimated that Devils Lake was at elevation 1,441 feet amsl in 1830. According to studies by J. P. Bluemle, Devils Lake's water level overtopped its natural outlet (approximately 1,459 feet amsl), to the Sheyenne River, at least twice in the last 1,800 years.

The lowest recorded elevation is 1,400.9 feet amsl, at which time the lake covered about 10.2 square miles. The lake climbed to a level of 1,438 feet amsl, an elevation that was reached in 1867, and reached a maximum recorded level of 1,449.3 feet amsl in the summer of 2005. The five water levels available from 1867 to 1901 were made at or near the site where the Minnie H. (a paddlewheel boat) docked historically and authenticated by the USGS. The current wet cycle, which started in 1993, has resulted in Devils Lake rising 26 feet. Recorded history has shown the elevation of Devils Lake to be quite variable, with extremes from overflowing into Stump Lake to being almost completely dry.

In August, 2001, Devils Lake reached an elevation sufficient to allow water to flow naturally from the eastern side of Devils Lake, through the Jerusalem Channel, into Stump Lake. In 2001, the divide between the two lakes sat at approximately 1,446.5 feet amsl. But by the summer of 2004, flows as high as 250 cubic feet per second (cfs) had eroded the divide down to below 1,446.1 feet amsl. Flows have continued throughout the winter of 2004-2005 due to the increased depth of water in the Jerusalem Channel.

While flows of as great as 250 cfs have benefited Devils Lake, all of that additional water has had a significant impact on Stump Lake, increasing the volume by approximately 95,000 acre-feet in 2005 alone. In effect, the Jerusalem Channel has been acting as a natural outlet to Devils Lake for the last four years. Stump Lake, which lies in the western portion of Nelson County, sat at an elevation of approximately 1,410 feet amsl in 2001. As of the beginning of March in 2005, the lake's elevation stood above 1,425 feet amsl, meaning that the lake has risen over 15 feet, flooding 1,800 acres with an additional 126,000 acre-feet of water.

A total of 1,785 square miles of contributing area enters the upper basin lakes. The NRCS lists approximately 307,000 acres of wetlands and about four million cropland acres (a 1:14 ratio of wetlands to croplands) in the counties associated with the Basin.

As the quantity of water in the Basin has increased, so too has the area of waterbodies. A study

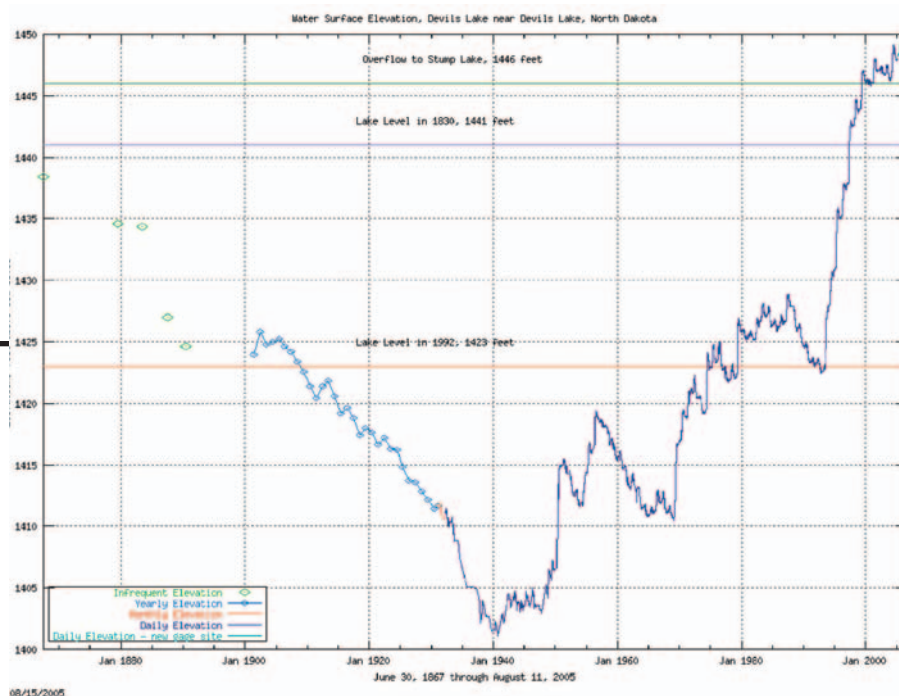


Figure 35. The recorded elevations of Devils Lake, 1860-2005. (Source: USGS)

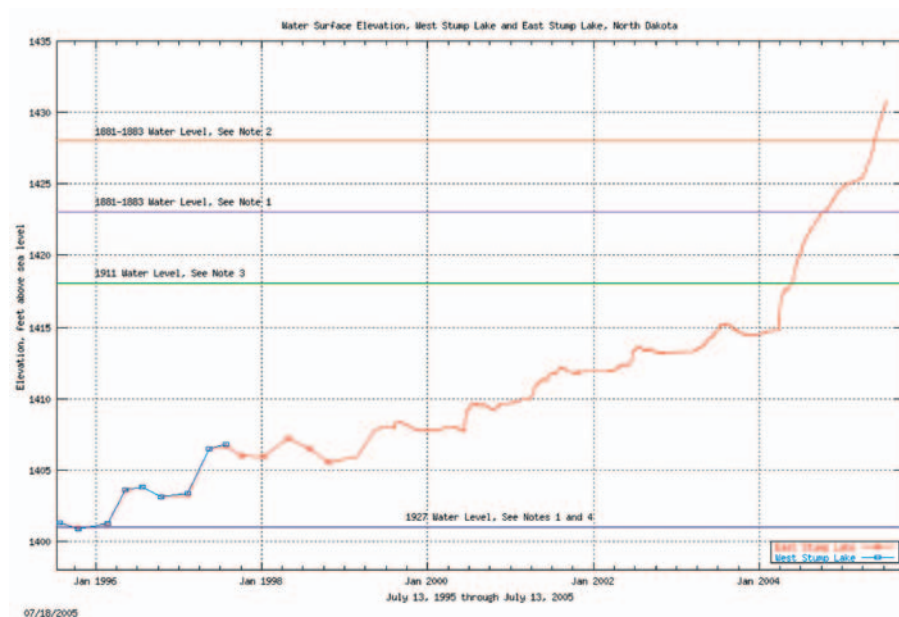


Figure 36. The recorded elevations of Stump Lake, 1995-2005. (Source: USGS)

commissioned by the Joint Board, and completed by North Central Planning, estimates that the area of deeded land lost to the rise of Devils Lake since 1993 to a lake level of 1,450 feet amsl with an area of approximately 81,000 acres. Of those acreages, 38,736 acres were cropland / CRP, 34,934 acres were pasture / hay, 672 acres were developed residential, 446 acres were

farmstead, 294 acres were parks / refuge, and 5,833 were classified as "other."

The damages to property in the Basin as a result of the current high water have reached \$400 million dollars to date, with the natural overflow level into the Sheyenne River being projected at approximately 1,459 feet amsl. In November 1994, the Joint Board estab-

SUBBASIN	CONTRIBUTING	NONCONTRIBUTING SQUARE MILES	TOTAL
Edmore Coulee	389	112	501
Starkweather Coulee	291	100	391
St. Joe Coulee	91		91
Calio Coulee	142		142
Mauvais Coulee	872	10	882
Little Coulee	263	158	421
Comstock	58		58
Devils Lake (north slope)	512		512
Devils Lake (south slope)	328		328
Stump Lake	488		488

Figure 37. Drainage Areas of Devils Lake Sub-basins.

lished the flood stage level of Devils Lake at elevation 1,427.5 feet amsl, approximately 32 feet lower than the natural outlet elevation, and the flood stage level has been achieved for over 9 years. A flood reaching the natural outlet elevation would affect over 200 miles of transportation system, over 240 miles of infrastructure system (i.e., water and sewer lines), about 900 permanent structures, and over 65,000 acres of land, to say nothing of the damage that could potentially be caused downstream by an overflow into the Sheyenne River. A balanced water management approach is necessary to address all of these issues.

Upper Basin Lakes

Flooding is a common occurrence in the upper basin lakes (Sweetwater, Morrison, Dry, Mikes, Chain, Alice, and Irvine.) Flooding in this area occurs when runoff waters from the 1,785 square miles of the watershed (about 60 percent of the area contributing to Devils Lake) flow into an area with relatively level topography. These well-developed upper basin drainage systems leading into the chain of lakes carry water more quickly than the system can effectively manage. Large amounts of water moving into this very flat area typically cause over-

land flows. Management of these lakes may be accomplished to help diminish flooding both around the lakes and downstream. In addition to the management of existing lakes, various wetland development projects have been identified in a water management plan for Lake Alice National Wildlife Refuge mentioned previously in this report.

The upper basin lakes stand at the confluence of several coulee systems; this fact combined with the flat topography of the area has long caused flooding for many of the landowners in the area. The opening of Channel A, a flood control channel constructed from Dry Lake directly to Devils Lake, diminished the upper watershed problem. Sweetwater-Morrison Lake and Dry Lake waters were then able to flow into Devils Lake, thereby reducing the flooding pressures on Mike's Lake, Chain Lake, Lake Alice, and Lake Irvine.

Despite these flood control measures in the upper basin lakes, the high level of Devils Lake itself, combined with continued high flows from the Edmore, Starkweather, Mauvais, Calio, and St. Joe coulees have all but negated any positive effects realized from the construction of Channel A, due

to the fact that water levels have connected Devils Lake to the upper basin lakes. High water levels have also made management of the upper basin lakes very difficult if not impossible. The result of flooding on Devils Lake has been the continued inundation of lands surrounding the upper basin lakes.

Devils Lake

There are three sources for water in Devils Lake, precipitation falling on the lake, runoff from the basin, and ground water. Prior to 1993, in the majority of years on record, the largest percentage of water contribution to Devils Lake came from precipitation falling on the lake, but since 1993 the largest percentage contribution has come from upper basin inflow. A simple explanation of evapotranspiration to precipitation ratios is difficult to obtain, due to the drastic changes in lake area. Groundwater inflow is only a small percentage of total inflow, but is relatively constant at about 3,000 acre-feet per year.

Since European settlement, evapotranspiration has been the single most important mechanism that removes water from Devils Lake, excepting natural overflow during extended wet cycles. Since 2001, as water began to discharge into Stump Lake via the Jerusalem Channel, flows have reached upwards of 300 cfs. The average annual evaporation loss for the Basin is 21 inches. The average annual precipitation at Devils Lake is 18 inches. The average yearly inflow in the 63 years prior to the release of the 1995 plan was 32,859 acre-feet. In recent years however,

weather has been anything but average.

The average annual inflow from 1995-2004 was approximately 291,000 acre-feet. The average annual net storage gain has varied from 70,000 acre-feet for 1969-1983 to as little as 4,530 acre-feet for 1931-1940. Also, from 1995-2004 the average annual net volume gain for Devils Lake was 239,000 acre-feet.

Water levels of Devils Lake have fluctuated between the outlet elevation of about 1,459 feet amsl, to the lake being nearly dry at about 1,398 feet amsl. Research suggests that lake levels have reached those extremes several times since glaciation. Besides climatic variability affecting the inflow to Devils Lake, the chain of lakes upstream of Devils Lake retains runoff and acts as an evaporation basin.

Damage from the rise of Devils Lake has also affected the state maintained park facilities on or near the lake. It is estimated that \$570,000 has been spent on restoring the three main parks on the lake, with an additional \$7,500,000 required to raise roads if the lake reaches 1,450.5 feet amsl. In 2004, funds were appropriated to raise the road to Grahams Island State Park to protect the structure to 1,460 feet amsl.

Local parks have been affected similarly to state parks. Minnewaukan, now on the shore of Devils Lake, has had to relocate the Humphrey Memorial Park to elevation 1,460 feet amsl, after the tennis court and swimming pool were wrecked by rising groundwater.

As the water has risen, forested areas along Devils Lake have been

inundated. Since the last basin plan was published in 1995, 3,876 acres of forested land have been impacted at the 1,446 feet amsl elevation of Devils Lake. In 2005, the Forest Service also began monitoring forested lands being inundated by Stump Lake's rapid rise. Between elevation 1,426 feet amsl and 1,436 feet amsl, approximately 13 acres of forested land will be lost. As of the fall of 2005, Stump Lake sat approximately at elevation 1,434 feet amsl.

North Dakota Water Permits

North Dakota, like other western states, follows the prior appropriation doctrine for water rights. Prior appropriation, which can be simplified by saying, "*first in use, is first in right.*" What this means, is that the earlier permitted and beneficial uses of water by a person, a company, or even a city, has priority over later users of the water, when less water is available. A good illustration of this concept is to imagine three farmers living along a small stream. All three of these farmers have a permit to use one million gallons per day of water in a stream that flows at five million gallons per day to irrigate their crops. In a "normal" year, there should be no problems. But if a dry year comes along, and the stream flows at less than its normal amount, problems can arise. If the stream's "normal" flow has been completely allocated via water use permits, and less of that water is available, then someone must lose their use of the water. In a prior appropriation state, such as North Dakota, the most senior of the

permits has priority of use. If there was only enough water for the most senior water right, then the other two farmers would not legally be able use that water.

Water Quality

Explorer Joseph Nicollet recorded in 1839 that the water in Devils Lake was too salty to drink. Because Devils Lake is a terminal lake, and only flows into the Sheyenne River once the lake's elevation reaches approximately 1,459 feet amsl, the nutrient load of the lake has been constantly increasing since the last natural overflow. However, the Devils Lake outlet will take some nutrients out of the lake system, albeit at a lesser concentration than would an east end overflow.

The United States Army, Corps of Engineers Reconnaissance Report (1992, p. 35) states:

"The Devils Lake watershed has probably always been fertile and provided large quantities of nutrients to Devils Lake, as the result of natural processes. However, human activities, in both urban and agricultural areas of the watershed, very likely have severely accelerated the runoff of excess nutrients that eventually enter the lake and accelerate problems there. It is often quite difficult to reduce nutrient inputs from natural sources, but in many cases it is quite possible and economical to reduce the human contributions. This means that there may be an opportunity to decrease the hypereutrophic conditions in the lake to conditions closer to pre-European settlement conditions. However, even with the best current technology, the lake would naturally be eutrophic."

There has been some progress in this area, with various water quality studies and projects; including a Section 319 water quality monitoring study completed by the Joint Board in 2001. It has been difficult to quantify the amount of nutrients entering into Devils Lake from each source in any given year, however the United States Geological Survey has been conducting sampling of the water quality of the coulees feeding Devils Lake for over a decade. In 2004, the Joint Board, in cooperation with the Red River Joint Board, and the Water Commission, funded an analysis of the water quality data collected. The Joint Board has also continued to fund the collection of water quality data. The City of Devils Lake has instituted a new and innovative sewage treatment program utilizing lemna, a wetland plant that has reduced the phosphorous load from that source by 20 percent to 33 percent. New agricultural production methods are also being pursued to reduce the volume and velocity of runoff from the lands thus improving the quality of the water entering watercourses. However, even with the annual variability in nutrient runoff, it is possible for scientists to estimate a long-term average annual loading of nutrients to a lake. It is recommended that a nutrient budget and an estimate of annual nutrient loading be done for Devils Lake in the future.

The Joint Board, the Water Commission, and the USGS are cooperating to compile all available USGS data concerning the basin into report form and as of the completion of this report, nearly 50

separate studies have been published. The new summary report will be used as a basis for determining sources and amounts of various loads to the lakes in the basin.

Since the beginning of the wet cycle in 1993, water quality in Devils Lake has dramatically improved, with decreases in total dissolved solids (TDS) and total dissolved sulfates corresponding to the rise in water levels.

Upper Basin Lakes

Besides the loss in crop production, many farmers believe that standing water in wetlands may contribute to salinity problems on nearby farmland, contributes to soil compaction problems on adjoining supersaturated farmland, and harbors noxious weeds. Managing these conditions increases production costs. While some disagree on the roles that wetlands play in soil salinization and compaction, this does little to change the firmly held beliefs of many farmers.

The Edmore, Starkweather, St. Joe, Calio and Mauvais Coulees' watersheds drain through the upper basin lakes (Sweetwater-Morrison Lake, Dry Lake, Mikes Lake, Chain Lake, Lake Alice and Lake Irvine). The impact of these lakes on the quality of runoff entering Devils Lake continues to be studied.

An assessment made by the Health Department concluded that detaining runoff water in these lakes for a period of time would allow nutrient carrying sediments to settle out and/or nutrients to be tied up by vegetation in the lakes. These lakes, through proper

management, may be an important part of cleaning the water before it enters Devils Lake. A detailed management plan for their operation is necessary. The wetland basins upstream are also important for nutrient uptake.

A concern of the Joint Board, and counties in the Basin, are confined animal feeding operations, or CAFOs. In these types of operations, large numbers of animals, such as pigs or chickens are raised in a very small facility. Some basin residents are concerned that the proximity of CAFOs to watercourses, such as a coulee, could lead to water quality degradation.

Devils Lake

Devils Lake is currently a relatively deep, sub-saline, eutrophic lake, characterized by large fluctuations in water level and in concentrations of chemical constituents and nutrients, which can have profound effects on the biology of the lake.

There is a concern held by many that all the salt from the many water softeners used in the City of Devils Lake may be contributing to the degradation of the water, but with the work on acquiring a new water supply, these problems will be eliminated. Livestock that have direct access to the lake may also be a source of contamination.

The Health Department states that periodic fish kills impair the lake, however this has not been the case for almost 13 years. Swimming, boating, and aesthetic enjoyment of the lake are reduced when algal blooms occur.

Devils Lake naturally overflows into Stump Lake at an elevation of 1,446 feet amsl, has done so in pre-European settlement, and has been doing so in recent times since 2001. Evapotranspiration is the main way water completely leaves the system when the basin is experiencing a “normal precipitation cycle;” the constituents brought in with the runoff are left behind. The lower the water level drops, the higher the concentration of TDS.

In 1989, eight water-quality sampling sites were monitored for TDS concentrations. The samples varied from 2,500 parts per million (PPM) at the Minnewaukan Flats in May, to 10,700 PPM at East Devils Lake in February. Over ten years after that study was completed, and increases in the volume of Devils Lake corresponded with increases in water quality, with a TDS at the West Bay near the Minnewaukan Flats of 1,140 PPM, and 5,450 PPM for East Devils Lake, a drop of nearly 50 percent. In 2003 and 2004, water quality sampling for the Devils Lake outlet showed continued changes (Figure 38). In comparison, seawater has a TDS of 35 parts per thousand.

Generally, highest TDS concentrations occur during the winter months, the lowest in the spring, and increase in the lake going from west to east.

The variations in TDS from west to east exist because most runoff water enters the system on the west end via Mauvais Coulee and Channel A.

Water quality, food, and habitat are the most important factors affecting the Devils Lake sport fishery.

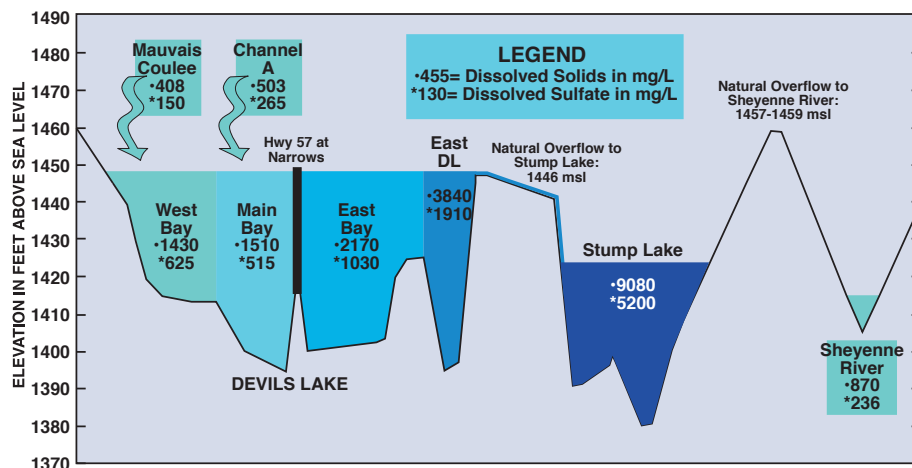


Figure 38. Water quality readings in the Devils Lake area in 2003 and 2004.

When the lake is at a low elevation, salinity of the water seriously impacts fish reproduction, however a larger concern is with excessive nutrients. Excess nutrients stimulate rapid growth of algae and plant life and increase the probability of anoxic conditions. Both winter and summer fish kills have resulted prior to the major runoff events that have occurred since 1993.

At elevations lower than 1,422 feet amsl, conditions in Devils Lake will probably result in a major fish kill. A 1990 stabilization report and a 1992 reconnaissance study analyzed ways to preserve the fishery and provide flood control for property surrounding the lake.

During a two-year period from September 1988 through October 1990, the USGS conducted a detailed analysis of the water quality of Devils Lake. The study took place with the lake at a relatively low level (1,425.7 feet amsl in 1989 and 1,424.3 feet amsl in 1990). The purposes of the study were to determine the nutrient budget of the lake, to provide a general description of water-quality and plankton relations in the lake, and to provide information to aid in evaluating lake-management proposals. The study period was relatively dry in the basin and is probably indicative of years of low runoff.

In 1992 it was estimated that the mass of total nitrogen in Devils Lake during the two-year study

period ranged from a high of 3,300 tons on August 15, 1989 to a low of 1,100 tons on September 12, 1990. External sources of nitrogen were minor concerning changes in the nitrogen mass between sampling periods. Precipitation was the greatest external source of nitrogen, but generally accounted for less than 10 percent of increases in nitrogen mass between sampling periods. It seems apparent from nitrogen mass calculations that, during the study period, internal processes caused much of the annual variation in nitrogen mass in the Devils Lake system. Those processes include re-suspension of organic matter, diffusion of dissolved inorganic nitrogen from the sediments into the water, and sedimentation of particulate organic matter from the water into the sediments. Fixation of atmospheric nitrogen by heterocystous blue-green algae probably also contributes to summer increases in nitrogen mass.

Estimates of phosphorus in Devils Lake ranged from 278 tons on August 15, 1989 to 54.1 tons on October 25, 1990. Discharge of storm water and treated sewage from the City of Devils Lake was the greatest external source of phosphorus during the study period but generally accounted for less than 5 percent of increases in phosphorus mass between sampling periods. External sources of phosphorus were minor concerning

changes in phosphorus mass between sampling periods. Since the 1989 study was completed, water treatment methods practiced by the City of Devils Lake have drastically reduced the phosphorous that the city releases into Devils Lake.

In 1992 a special assessment of the effects of fish harvest and migratory waterfowl waste on nutrient levels in Devils Lake was conducted. Using estimated fish harvest figures provided by the Game and Fish and assuming fish contain 2.5 percent nitrogen and 0.2 percent phosphorus, the total masses of nutrients removed from Devils Lake during 1989 and 1990 were relatively very small. It is unlikely that fish harvest plays an important role in the lake's nutrient balance.

The second consideration concerned migratory waterfowl. According to this research, the effect of migratory waterfowl waste on the Devils Lake's nutrient balance is not large. Also, the nutrient contribution by waterfowl occurs during the time of the year when nutrient masses in the lake typically decline. Nutrients supplied to Devils Lake by waterfowl do, however, contribute to the nutrients that accumulate in the sediments.

Nutrient budgets indicate that internal loading and sedimentation processes generally account for variability of masses of nutrients in Devils Lake (at least in years of minimal inflow from the watershed.) The Health Department continues to sample water quality in Devils Lake four to six times per year, and to work on programs reducing nutrient loading in the lake.

The Health Department has also completed a study examining the chemical, physical, and biological parameters of Devils Lake. This study looked at how water quality changes in the lake over time. In addition, the Health Department also does periodic water quality testing on the Devils Lake chain of lakes. The Health Department conducts a complete water quality analysis at seven sites, four to six times annually.

The Health Department also does Section 319 non-point source water pollution Best Management Practices (BMP) in the upper basin. The Health Department was involved in a major project designed to reduce nutrient loading by the City of Devils Lake. This innovative project captured municipal waste, and treated it using an aquatic plant known as lemna. This treatment system resulted in a reduction of phosphorus input into Devils Lake by up to 80 percent, with drastic reductions in nitrogen and ammonia as well. This project had the added benefit of providing nutrient-rich fertilizer to be used for agriculture.

Estimating Wetland Storage

There have been numerous studies conducted by various agencies into the amount of storage in the upper Basin, sometimes with widely varying numbers. However, there are essentially four major difficulties in estimating wetland, or depressional storage: the lack of adequate ground-truthing, the location and status of drained and par-

tially drained wetlands, the timing and quantity of precipitation, and predicting depressional water loss. The following section will briefly describe these difficulties.

One of the greatest causes of confusion for people trying to understand the issue of wetland storage, is the difference between a depression and a wetland. A depression is a basin of some sort that has the potential to be filled with water to a level where it naturally spills. Wetlands, are often found in the lowest point of a depression, and are a feature of the landscape that have characteristics people often associate with wetlands, such as cattails, bull rush, open water, hydric soils, and waterfowl. While a wetland is often filled with water for at least some portion of the year, many depressions are seldom completely filled. This is for the simple reason that it would take a significantly greater volume of runoff to fill a depression, than it would to fill a wetland within that depression. Also, while a depression may be capable of holding a certain amount of water, the size of the watershed contributing to that depression might be too small for a sufficient amount of run-off to accumulate to fill the entire depression.

The importance of understanding this point lies in the fact that many studies talk about depressional storage, as opposed to wetland storage. While this provides a convenient means of quantifying storage, it is not the same thing as wetland area or wetland storage. As a result, while a study may state that there are X number of acre-feet

of depressional storage, the actual wetland storage volume could be much less.

Ground-Truthing

The best way to measure something, such as determining wetland storage, is to measure it, as through surveying. The next best method is to take remote sensing data (such as aerial photography or satellite imagery,) and then ground-truth a limited number of sites, say 5 percent of the total area being studied. Ground-truthing is a technique used to verify remote sensing information that is used when a detailed survey of an entire area is impractical. The information gained from sample sites is then expanded to represent a much larger area. The accuracy of the final result is reliant on the amount and accuracy of ground-truthing that has been done. The least effective method is to rely solely upon remote sensing data, and not make any effort to physically verify it.

Many of the studies that have been conducted on depressional storage in the Basin, have been limited by minimal amounts of ground-truthing. This is often due to the significant extra costs and time involved, and as a result, the accuracy is affected. Some of the studies done in the Basin have had more limited ground-truthing than others. It is important to understand the limitations that minimal ground-truthing imposes on any of the existing studies.

Partially Drained Wetlands

Wetlands are not always completely drained. Partially drained

wetlands represent a major complication in assessing the actual acreage and storage potential within the Basin. Some studies consider partially drained wetlands as being completely drained. While doing this makes it easier to estimate wetland storage for the entire Basin, it is not representative of the wetland's true useable holding capacity. For example, a wetland that holds 5 acre-feet of water could be drained to the point that it only stores 1 acre-foot.

While it may be easier to consider that wetland as being completely drained, doing so does not give an accurate estimate of the actual amount of storage available in the wetland or the depression as a whole. Many of the studies done that estimate wetland storage in the Basin, have considered any drained wetland, as being completely drained. In fact, sometimes the drainage of a smaller wetland simply moves that water from one wetland in the depression to another, resulting in no net gain of water outside of the depression.

The Timing and Quantity of Precipitation

Predicting depressional storage is complicated by the timing and quantity of precipitation. The majority of the precipitation (both snow and rainfall) that this region receives generally occurs in the spring. The period of greatest precipitation can also coincide with the melting of winter snowpack. While the moisture content of snow is highly variable, on average, ten inches of snow yields about one inch of liquid water. So while the

actual amount of water found in ten inches of snow and one inch of rain might be the same, the snow occupies ten times the volume.

If the majority of a year's precipitation occurs when the snowpack is still present in the spring, or in the fall, when wetland's lose less water, then wetland storage can be much less effective. This has occurred in the Devils Lake region repeatedly over the last decade. In this situation, the actual storage available in a depression is much less than is evident from the actual water content of the snow. Flooding could also occur if there was an early and warm spring, before all of the snowpack had melted off, because the snow occupies a greater volume than the capacity of the depression.

Unusual fall rains have been the single greatest contributor to the significant rises in the elevation of Devils Lake. The flooding problem was also magnified in the winter of 1996-1997, when some parts of the region received ten feet of snowfall. Even though the actual amount of water in the snow was about 12 inches, the spring melt occurred quickly while the ground was still frozen, resulting in rapid runoff.

Predicting Wetland Water Loss

Another difficulty in predicting wetland storage, lies in accounting for the effects of water infiltration into the soil, evaporation, and transpiration (plants using water). Some wetland storage studies use these three effects to estimate the amount of water that a depression could potentially consume over the



Figure 39. Rainfall can have a significant effect in the Basin.



Figure 40. The immense numbers of wetlands in the Basin, as shown here in 2004.

course of a year, not just the maximum volume of the wetland. During much of the year, water infiltration into the soil, evaporation and transpiration occur at very low rates, if at all, as the ground is frozen and covered with snow, and the average temperature is below freezing. As a result, these three factors would have a greater effect during the growing season.

Major summer storms can lead to large amounts of runoff, such as occurred in the Basin in 1993, and other years, when the amount of precipitation was greater than the available wetland storage. Ideally, in order to maximize wetland water loss, precipitation would come regularly over the course of the growing season. However, the reality of the situation is that rainfall comes in fits

and spurts, often during thunderstorms.

The effects of evaporation, transpiration, and groundwater infiltration are not as great when precipitation comes in large amounts at one time, or when precipitation occurs in the winter, and plants are dormant, with evaporation also greatly reduced. This is a major limitation of those studies that predict the storage of wetlands throughout an entire year, by incorporating wetland water consumption. While studies attempting to estimate depressional storage are valuable, the four major limitations previously described must be understood and considered whenever the subject of depressional or wetland storage is being discussed.

Wetland Storage in the Basin

Over that last 20 years, studies on depressional storage in the Basin have been performed by various private, state, and federal agencies; including the Fish and Wildlife Service, the USGS, the Bureau, West Consultants Inc., and the Water Commission. The most recently completed was an extensive study completed in 2001, commissioned by the United States Army Corps of Engineers, and conducted by West Consultants Inc. The scope of the study was to develop a physically based hydrologic model to simulate the hydrologic functions of identified depressions. This included an estimate of pre- and post-drainage wetland storage in the Basin.

Wetland storage in the study was determined utilizing a combination of digital elevation models, aerial photos, National Wetlands Inventory data, flow direction data, and digital quad maps. Wetlands were split into two categories, possibly intact and possibly drained. Researchers found that there were approximately 202,990 acres of possibly intact wetlands, with approximately 481,604 acre-feet of storage, and 92,429 acres of possibly drained wetlands with approximately 132,729 acre-feet of storage. However, when running ten different climate sequences based on United States Geological Survey hydrologic models, and incorporating both wet and dry years, the average annual runoff reduction was 23,841 acre-feet. That amount of storage would only lower Devils Lake at its current elevation, by approximately 4 inches annually.

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